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"To Promote the Science and Improve the Methods of Fire Protection and Prevention."

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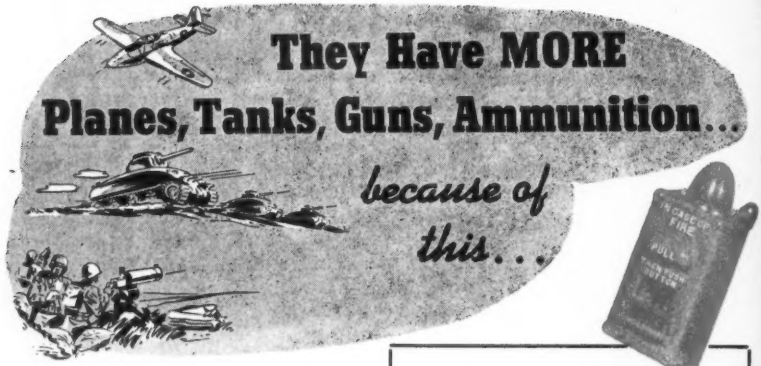

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NON-DAMAGING FIRE EXTINGUISHING SYSTEMS

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A NON-PROFIT TECHNICAL AND EDUCATIONAL ORGANIZATION

To promote the science and improve the methods of fire protection and prevention.

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Reports of fires appearing in the Quarterly are copies of or extracts from written reports forwarded to the Association. This Association, as a body, is not responsible for the statements or opinions of any of its members.

Day by day and night by night, fires large and small take their toll of life and material resources that should contribute to the war effort. Careless fire is just as destructive as enemy bombs. This fire, in Plymouth, N. H., on the night of Jan. 5, 1943, destroyed several buildings and important contents with a loss of $310,000.

The Quarterly

Vol. 36 April, 1943 No. 4

Fire Departments and the War.

By Warren Y. Kimball,
N.F.P.A. Engineer.

It is probably a good thing for the peace of mind of Mr. Average Citizen that his thoughts are preoccupied with problems of war in distant places so that he is not much troubled about the very present danger of serious fires at home —fires that are having a marked bearing upon our wartime economy. He does not notice, for example, that the fire trucks he used to see going through the streets with a minimum of five or six men now commonly respond with but two or three men. Perhaps he does not notice that the driver of a fire truck is an officer who has been forced to take the wheel because a fire company has been so depleted that there are insufficient apparatus operators. It is true that fire company crews of say three men can and do put out small fires that only require a booster line or other small hose. But it is also true that the number of big fires occurring in almost every part of the United States has soared rapidly as the war has progressed.

Fire prevention experts agree that had adequate private fire protection been provided, many of these large losses would not have occurred. However, private fire protection has never been reasonably adequate in more than a small proportion of the properties of a given city. It is largely for this reason that public fire protection is a municipal function. Under wartime conditions of priority restrictions, private fire protection is, in many instances, becoming even less adequate as compared to values at stake and even greater dependence must be placed upon the public fire fighting forces. Obviously, fire crews that fall far below the usual schedules for manpower cannot be expected to give adequate service in the event of fires which require the prompt use of numerous hose streams, large scale ladder operations, or fire fighting under conditions of smoke and heat which seriously reduce the efficiency of the individual firemen.

several buildings and important contents with a loss of $310,000.

As the shortage of manpower becomes more acute throughout 1943 and possibly through 1944, it is likely that fire department officials will be faced with the necessity of taking drastic steps to keep fire department manning up to at least a reasonable minimum.

With the loss of younger firemen to the military service the average age of fire fighters in some departments has risen to an alarming degree. In many cities a further loss of the younger men may impair the efficiency of the department in fire fighting operations. For example, the average age of privates in the Boston Fire Department is reported at over 45 years. In New York City men up to 45 years of age are being certified as eligible for appointment to the fire service as substitutes for the more than 500 firemen now in military service. It is reported that consideration is being given to the raising of the age limit for appointees to 50 years. This is to be compared with maximum upper age limits for appointments varying between 30 to 35 years for most cities prior to the war. The effect that the high age limits for firemen may have upon the pension costs in many communities will be one of the post war municipal problems. Also the high appointment ages will bring new men into the department who are older than many experienced fire department officers under whom they will serve.

Circumstances affecting fire department manpower include loss of many of the younger men through selective service, and military leaves to experienced members who have had previous military experience or have qualified as specialists in the armed forces. Many firemen and officers have resigned to take more lucrative positions in war industry. Others, desiring a more certain draft deferment status in localities where draft boards have not been sympathetic to fire department needs, have done likewise. Retirement of members who have reached statutory retirement age limits or have retired due to disability has further reduced the normal strength of fire departments. Difficulty is encountered in securing adequate numbers of new members because established rates of compensation for firemen have not been adequately adjusted to compete with private war industry and because in most communities the hours of duty for firemen are excessive as compared with almost any other occupation, including the police departments in the same communities.

New fire department employees are commonly required to serve a probationary period at low pay, and in most fire departments it takes several years before a fireman reaches first class status and compensation. In normal times the probationary period doubtless has distinct advantages in making it possible to test a candidate's adaptability to actual fire fighting service before the appointment becomes permanent. During the war emergency the slow but careful routines for selecting firemen may prevent desirable men from entering the service. Many communities have made provisions for the appointment of "military substitute firemen." However, as positions must be held open for

the firemen returning from war service it is obvious that permanence of appointment and future pension privileges may not be guaranteed the substitutes. Experience in some departments has shown that the turnover of military substitutes has been quite considerable. Frequently, when a fire department obtains from the civil service authorities a list of men eligible for appointment it is found that only a limited percentage of the men are actually available.

After men have been appointed to the fire department some inevitably drop out due to dissatisfaction with the wages or with the long hours of duty which in most fire departments average 84 hours a week. Others who desire to remain with the department are often called for selective military service because such men seldom have sufficient fire fighting experience to qualify for draft deferment, even though they may be essential to provide the manual strength needed to carry out fire fighting operations under the direction of the older men who are experienced firemen.

The manpower problem will vary in accordance with local conditions, but municipal officials should not hesitate to take appropriate action to assure adequate fire protection, even where it is necessary to depart somewhat from long established routines and precedents through which the average fire department functions. Some possible emergency steps are discussed later in this article.

Fire Equipment Obsolete in Many Cities.

Fire departments, in general, have another wartime problem that in many communities is second only to that of manpower. It is the matter of apparatus, hose and equipment. During the depression years almost every city seriously curtailed its purchases of major fire apparatus and hose. It was felt by the city fathers that the fire trucks could be made to operate for a few years longer than under normal conditions. Fire hose likewise was replaced with less frequency.

A survey of the age of municipal fire apparatus published in the July, 1941, QUARTERLY showed that during the spring of 1941 nearly 52 per cent of the municipal fire apparatus in the cities of more than 25,000 population was obsolescent by reason of age. In view of the fact that comparatively few units of new apparatus have been manufactured for municipal use since the United States entered the war, it is likely that obsolete municipal fire apparatus now approaches 60 per cent. It has been customary to consider as obsolete all apparatus having more than 15 years of service, although such apparatus is commonly considered useful as reserve equipment if properly reconditioned. From a standpoint of usefulness for fire fighting, apparatus which is more than 15 years old may lack many of the improvements developed for both motor trucks and fire apparatus within that period. Even with the best of care such equipment may have become undependable. However, should some persons wish to quibble over an arbitrary age figure of 15 years for obsolescence, it

might be pointed out that the 1941 survey showed more than one-quarter of the apparatus in active service to exceed 20 years of age. Undoubtedly, the equipment in this upper age bracket at the present time approaches 30 per cent or more.

Another problem related to the operation of fire department equipment in wartime has been the difficulty experienced by many fire departments in getting parts for necessary repairs of apparatus damaged by accidents or breakdowns. In several instances fire chiefs have reported that important apparatus has been out of service for longer periods than would be necessary under normal conditions. While on the subject of repairs it might be mentioned that some departments might be able to relieve the load of work in the department shops by having more routine maintenance work done at the fire stations or other suitable locations. Such work would be done under the direction of the maintenance force with the aid of apparatus operators and other qualified firemen.

Some persons may wonder why the many units of auxiliary fire equipment distributed under the civilian defense program do not constitute an effective substitute for some of the over-age municipal fire apparatus. Such equipment has not been designed to perform regular municipal fire fighting services. It is purely emergency equipment for use by civilian auxiliaries in the event of air attack. It is also used in training the civilian auxiliary firemen. None of the emergency pumping equipment is being provided on standard fire department motor chassis or other suitable truck chassis. Each city using such equipment is expected to find means of conveying the auxiliary pumps, hose and appliances in the event of an emergency.

Some Possible Emergency Expedients.

While it is impossible to prescribe in detail all of the emergency steps that might be taken to mitigate the deficiencies in fire department manpower and equipment, some of the following suggestions indicate some emergency steps that might be taken when applicable during the present emergency.

As a first step the compensation of firemen should be brought into line with the present value of labor in the community or area in which each fire department is located. The following table, prepared from data in the 1942 Municipal Year Book published by the International City Managers Association, is indicative of the pay scales prevailing last year in the fire departments of the United States. Most significant, perhaps, are the median figures for both starting pay and maximum compensation for fire department privates (exclusive of officers). In all except the largest cities the median starting pay for firemen was under $150 a month, and in many departments the highest compensation for the fire fighter in the ranks, regardless of years of service, was only slightly above this figure.

Salaries of Firemen.

(From the 1942 Municipal Year Book.)

Population Group	Cities Reporting	Entrance Salaries			Maximum Salaries		
		Lowest City	Median City	Highest City	Lowest City	Median City	Highest City
Over 500,000	14	$1,600	$1,843	$2,160	$1,900	$2,355	$3,000
250-500,000	22	1,080	1,720	2,160	1,740	1,980	2,500
100-250,000	55	1,200	1,728	2,100	1,560	2,040	2,700
50-100,000	106	....	1,655	2,200	....	1,890	3,000
25-50,000	207	720	1,622	2,311	900	1,860	2,750

Where there is an apparent shortage of manpower in the fire department one of the first remedial steps should be a study to assure the maximum usefulness from the available manpower. Some fire departments are burdened with numerous so-called "details" which, while perhaps serving a useful purpose when adequate manpower is available, could be curtailed or eliminated altogether during the war emergency. Traditionally, the fire department is the "Jack-of-all-trades" of each community. When a church steeple clock needs winding,—the firemen are called. When a playground is to be flooded for ice skating,—the firemen are called. When a person is locked out of the house,—the firemen are called. Even more important, many fire departments are needlessly burdened by their own routine. Firemen are out of quarters checking on the condition of hydrants that might be made the responsibility of the water department, or checking on fire alarm boxes that could be the responsibility of the electrical department or fire alarm service. Firemen frequently direct traffic and do numerous other jobs that have little or no bearing on fire protection, but that reduce the effective fire force available to respond with the apparatus to alarms of fire.

In a few large cities the fire prevention bureau as at present constituted has become burdened with men who have perhaps lost any enthusiasm they may have once felt for active fire fighting and were able to obtain a detail to less arduous work. Many of these men have no specialized knowledge of fire prevention subjects that would make them of particular value to the fire prevention bureau. Most authorities believe that the fire prevention bureau should be an office of specialists and supervisors who would handle problems referred to the office by the various company and district fire officers. Thus it might be possible in cities having a large fire prevention bureau to return some of the bureau personnel to the individual fire companies, where they would be expected to carry out routine inspections at such times as their company had a surplus of manpower above the minimum necessary for efficient fire fighting. This would have another advantage in that the inspection services by the fire companies would be increased and many hazards removed before they required the attention of the fire prevention staff at headquarters. Further, this would be an excellent means of weeding out the less valuable members of the head-

quarters fire prevention staff who could be replaced eventually by specially trained men.

An additional source of help for a few short-handed fire departments may be found in firemen who have been detailed to clerical work at headquarters. It may be possible to replace some of these men with women clerks. Likewise, some men detailed to the fire alarm office might be replaced by women. However, frequently men detailed as clerks are those who have been partly disabled in the line of duty.

Some cities have utilized auxiliary firemen, who have been given the regular basic training for firemen, allowing them to serve as extra bunkmen on the night shift. These men are used to help run lines of hose and to raise ladders, but are not expected to do the more dangerous jobs, such as entering burning buildings. This is purely an emergency action, and presumably many auxiliary firemen would be willing to serve perhaps one night a week with the fire company to which they have been assigned for emergency duty.

Another suggestion that might prove helpful in some cities is to have a ranking officer of the department appointed as supervisor of manpower. It would be the duty of such an officer to check up on manning schedules each day sufficiently in advance to permit details to be made to keep up the minimum strength required for effective operation of every company unit. If company officers reported their expected manpower for the ensuing day to their district or battalion chief, he could make the necessary details and report conditions to the manpower officer at headquarters. Such a system if properly worked out should go far toward eliminating inequalities of manning between fire department units.

While admittedly it is not always possible to keep company strengths up to an authorized "paper strength," it would be very desirable to establish a minimum manpower figure for each company and to see that the minimum is maintained. If a company falls below the minimum it should be considered as not ready for duty and its normal assignments should be covered by another unit until a special detail has been made to provide adequate manning. When a fire company is at its minimum figure no member should be allowed to leave quarters on any special detail unless additional help has been secured.

In a number of cities the desire of many firemen to earn extra money by outside employment in order to keep abreast of the increased cost of living has presented a problem which has not always met sympathetic response from fire department officials. If individual men want extra work they should perhaps be given opportunity to do work of direct benefit to the fire department or to fire protection. For example, they might be allowed to do overtime work at the fire department repair shop, or as private fire guards at defense industries, or work one or two extra shifts a week in their own fire station for additional compensation.

Emergency Revision of Fire Company Assignments.

One possibility that would be worth consideration in many cities would be an emergency revision of normal assignments to make up for deficiencies in company strength. For example, it might be desirable to increase the response to second alarms to assure that all important fires will have an adequate fire force on hand at the earliest possible moment. In some cases it may be desirable to designate certain ladder companies as reserve units as far as response outside of their local alarm district is concerned. This ladder company manpower could be borrowed to keep engine company crews up to an effective standard. Ladder companies are seldom dispatched to large fires in the same ratio as engine companies. For example, a fire calling 15 to 20 engine companies may only require four or five ladder companies. Thus, while the number of ladder companies initially available may not be large, a disproportionate number are often left in quarters while the engine companies are fighting a large fire. When insufficient men are available with the engine companies to make full use of the engine company equipment, as is often the case, it is suggested that ladder company crews be used to run hose lines and do other tasks normally assigned to the engine companies. Where ladder companies share joint quarters with engine companies they could be assigned to respond together as a unit in the event of multiple alarm fires, whereas the present practice in most departments is to give engine and ladder companies completely independent assignments. If desired, orders could be issued for certain ladder company crews to leave their apparatus in quarters and to respond to large fires on the apparatus of an engine company, thus giving the engine company double manpower. Obviously, this is not to imply that the required response of ladder companies, as such, should be diminished, but rather that surplus ladder crews would be utilized to a greater extent for fire fighting. Where reserve pumper apparatus is available it would be possible to designate certain ladder companies which would operate as engine companies whenever the number of engine companies in quarters throughout the city fell below a predetermined figure.

Another important reason for possible emergency revision of fire department assignment cards is that many important war industries have been located on the outskirts of industrial communities. Normal fire department assignments have been designed to bring heavy concentrations of fire apparatus into central mercantile and manufacturing districts, frequently at the expense of the coverage of outlying areas. For example, in many communities a second or third alarm "downtown" calls in a great part of the outlying fire companies to fill-in at intown stations. In some communities this practice now is removing fire protection from vital war plants.

Several fire departments, notably Baltimore, Maryland, and Washington, D. C., have for many years made especially effective use of reserve apparatus

manned by the off-shift, which has been called back to duty in the event of major fires. Baltimore has more than 30 fully equipped "second-line" pumpers and a number of ladder trucks which, after having served their usefulness as first-line apparatus, have been reconditioned as a reserve force which is manned by off-duty firemen.

In some departments, where at least a part of the engine companies are equipped with a separate hose truck in addition to the pumper, it has been the practice under emergency conditions to respond to certain alarms with the hose truck only, leaving the pumper in quarters with a driver to await the arrival of the offshift. The reason for this is that at most fires the apparatus of the individual companies is adequate to provide equipment for more hose crews than are normally assigned to the apparatus. For example, a pumper capable of supplying three good streams may have only men enough to handle one line. Also the first pumpers to arrive at a fire are connected to hydrants nearest the fire. Greater efficiency of operation is usually obtained by utilizing the full capacities of these pumpers. In areas where adequate water supplies are available at high pressures, or where separate high pressure fire mains are provided, it is not uncommon to see idle pumpers parked about the fire area, apparently serving no useful purpose. These machines should be in quarters, where they would be available for use at other fires requiring pumper service. The practice of leaving part of the pumpers in quarters for additional alarms not only provides a reserve of equipment but also provides additional hose crews for the full utilization of apparatus already at the fire.

Apparatus Replacement Programs are Important.

It is strongly urged that every fire department maintain a detailed inventory record of the age and condition of its apparatus. Adequate fire apparatus is essential for effective protection of the home front against the huge fire losses that are now seriously slowing the war effort. Each fire department should be permitted to establish and follow a definite replacement schedule for all major fire apparatus. Had this been done in the past the war would not have found municipal fire departments so ill prepared as to the condition of their equipment. Fortunately, it appears that a reasonable amount of new fire apparatus will be obtainable by municipalities desiring to make purchases this year. It is suggested that each fire department having apparatus needing replacement should request appropriations for such apparatus. Due to the war, priorities are not likely to be granted for specialized apparatus, such as water towers and rescue trucks, that put an extra burden on apparatus manufacturers. However, standard pumpers and other apparatus meeting N.F.P.A. specifications and capable of passing underwriters tests can be obtained for many communities, particularly those having war industries.

At this point it may be fair to observe that, for many cities, the wartime necessity for buying standard apparatus may be an eye-opener when the fire

department learns what excellent apparatus can be obtained under standard specifications, generally at a financial saving to the municipality. In wartime it is as unreasonable for a city to try to buy a custom-built pumper as it would be for the fire chief to ride to fires in a custom-built automobile. No doubt one of the foremost reasons why much of the municipal fire apparatus now in service is over-age is because it was originally such expensive custom-built equipment meeting the peculiar ideas of each local fire department, that the city could not afford to maintain a reasonable replacement cycle for all of its fire companies. Thus, while much of the old apparatus now in service may have been in the nature of a "de luxe" job 20 years ago, it may lack many of the improvements now found on standard fire apparatus.

Where it is not possible to replace all of the obsolete apparatus now in service, every effort should be made to reduce the assignments of the older apparatus so as to give the greatest load of work to the equipment in the best mechanical condition. The newest apparatus would generally go to the busiest companies and the older equipment would be stationed in the less active areas. Another suggestion would be to so distribute the equipment that no one section of a city had a dangerous proportion of obsolete or unreliable equipment.

Gardner Roberts.

Wartime fire fighting in Portland, Maine, March 29, 1943. Fire striking this Salvation Army workshop for the third time in five months finally completed its work of destruction. The city firemen are assisted by auxiliary firemen in white helmets at the right of the picture. Coastguardsmen, also responding to this fire, may be identified by their white sailor hats.

Seattle Bomber Crash Fire.

A Boeing four-motored bomber on a test flight from Boeing Field near Seattle hit a high tension wire and one engine took fire. The pilot was trying to return to Boeing Field, but lost control and the plane crashed into the fourth floor of the Frye Packing Company plant at Seattle. An explosion followed and the plant was immediately enveloped in flame. The death list includes eleven men in the plane, a reported twenty employees of the packing company, and one fireman, who died subsequently from refrigerant gases that he inhaled while searching the ruins of the building for bodies. The crash occurred at 12:28 P.M. At 12:30 several hundred workmen would have been in the building and the loss of life would presumably have been very much heavier. The plane barely missed a large office building fully occupied with naval personnel.

The moment the bomber hit the roof the gasoline tanks were ruptured, escaping gasoline ignited, and there was no opportunity for escape. The plant fire brigade immediately went into action. While they were unable to save any

Acme.

Thirty-two lives were lost when a four-motored bomber crashed into a meat packing plant in Seattle. This picture shows part of the wreckage of the plane in the foreground, where it crashed through a section of the roof.

Acme.

One of the greatest fire tragedies on the Pacific Coast in recent years occurred on February 18, when an Army bomber on a test flight crashed into the huge Frye Packing Company plant at Seattle, Washington. Flaming gasoline was scattered throughout the building. Thirty-one men and a woman lost their lives. The falling roof broke sprinkler piping. Among the fatalities was a city fireman overcome by escaping refrigerant gases while searching the ruins. Captain Stephen E. Sanislo, Safety Education Director, Seattle Fire Department, reports that prompt work by the plant fire brigade helped check the spread of the fire to adjoining frame buildings and that civilian defense forces proved their worth in this disaster. Chief William Fitzgerald reports that fourteen engine companies supplied 32 hose streams.

of the victims, they were successful in preventing the spread of the fire to other buildings at the plant, of frame construction. The Seattle Fire Department responded immediately and did a good job of fire fighting. Soldiers, sailors and Coastguardsmen were also present.

There is no information as to the monetary loss involved in the plane. The loss to the packing plant, including building, equipment, stock and business interruption, will probably be $600,000 or more. The unusual circumstances of this fire seem to involve complex questions of liability for the damage.

Sprinkler Protection in War Industries.

Automatic sprinkler protection is an exceedingly important factor in maintaining the continuity of war production, extinguishing in their incipiency fires which might otherwise destroy production facilities and stocks of raw materials and finished products with serious effect upon the war program. The record of industrial plants which have installed properly designed and maintained sprinkler systems has been very favorable. Over a period of nearly fifty years the records of the National Fire Protection Association show that automatic sprinklers are highly efficient and perform their designed function in a very high percentage of all fires. We estimate that there are some five to ten thousand fires a year in sprinklered properties and that in more than 98% of the cases the operation of the sprinklers is successful, either in completely extinguishing the fire or in holding it in check and preventing its spread pending extinguishment by other means. Fires classified as "held in check" are largely those where the fire originates in some place where the water from the sprinklers cannot reach it, as under a table or bench, and is accordingly not extinguished by the sprinklers, but is prevented from spreading and can be readily extinguished by manual means.

In the 2% or less of the cases where automatic sprinkler operation is not successful, the failure is usually not the fault of the automatic sprinkler system itself, but is due to the shutting off of the valves controlling the water supplies or the failure to maintain equipment in operative condition, or, in some cases, explosions which wreck the system, making it powerless to control the ensuing fire. These cases of sprinkler failure, while constituting only one or two per cent of the total, have received a disproportionate amount of publicity in the QUARTERLY and other publications of the National Fire Protection Association, largely because of the special interest that attaches to these exceptional cases and the important lessons that they present. Likewise, extensive publicity is given to large fires where heavy losses have occurred because of lack of automatic sprinklers.

Little attention seems to have been given to the 98+% of cases where the automatic sprinklers do their job. In such cases there is no newspaper publicity, little or no interruption of production or monetary loss. In order to present a true picture of the effectiveness of automatic sprinkler protection it has seemed desirable to secure data on a number of typical fires in which sprinklers have done their job. The N.F.P.A. Department of Fire Record accordingly selected at random 100 fires in war industries during the past year where we had information that automatic sprinklers had operated. In each case we

wrote letters direct to the companies and asked them to give us their story of what happened. We emphasized the importance of prevention of interruption to production rather than loss in dollars, and asked reports in terms of man hours of production. About fifty replies have been received up to the time of publication of this article. These replies are 100% favorable to automatic sprinkler protection. In about half of the cases the information is not complete in all details or the company for one reason or another prefers not to have the story published. In the following 22 typical cases, however, the story can be given; we feel that the following reports speak for themselves. These reports in some cases have been condensed from the original letters, but have not been selected or edited for publication.

Sprinklers Save 1,639,000 Man Hours.

"The fire occurred about 12:30 A.M., October 25, 1942, on the fifth floor of a warehouse, 259 feet long by 60 feet wide. The entire warehouse was filled with cloth, mainly ducks and heavy goods for our armed forces, both in the dyed state and waiting to be dyed. There was approximately 12,000,000 yards of cloth in this warehouse, about evenly distributed between the five floors, averaging 12 ounces to the yard, or approximately 9,000,000 pounds. Approximately 40% was in the dyed state and approximately 60% in the undyed state as received from the mill. The fire was discovered by our night watchman upon hearing the motor alarm gong. When he went to the fifth floor it was almost impassable because of the smoke. One sprinkler completely extinguished the fire. The entire warehouse being filled with this combustible cloth, the whole building would undoubtedly have gone had it not been for this sprinkler protection. It was estimated that it would have taken 1,444,000 man hours to make the cloth alone and an additional 120,000 man hours for the part that was dyed, a total of 1,564,000 man hours. There would have been approximately 75,000 man hours lost in the building itself, which was brick on steel construction. Frankly, we would not care to operate a plant without full sprinkler protection."

Mr. J. A. Simmons, Vice-President and General Manager,
Lanett Bleachery and Dye Works,
Lanett, Alabama.

Sprinklers Save Warehouse of Critical Material.

"A small fire occurred in our warehouse on October 16, 1942. This fire undoubtedly started from the sun focusing on a small corner of paper excelsior protruding from a crate near a window. The spot was in an isolated area of the warehouse and, if it had not been for our sprinkler system, it is quite possible the loss would have run into several thousands of dollars instead of a few hundred dollars, which was mostly caused by water damage. Based on the warehouse capacity and assuming half of the contents would have been lost by fire or water, it is possible the lost man hours of production would have been about 30,000, and, in addition, the loss of critical materials would have caused more serious delay due to the delay of securing additional supplies. We are,

of course, fully alive to the advantages of the automatic sprinkler system as a fire loss protection device and, also, as an investment, as the first cost of our installation was paid for out of insurance savings several years ago."

Mr. L. M. Gauntlett, Assistant Secretary,
Square D Company, Electrical Equipment,
Los Angeles, California.

Three Fires Controlled by Sprinkler Within Two Months.

"The fire which occurred July 9, 1942, was followed by two similar fires in exactly the same spot within a period of two months. These three fires all occurred in the settling box below our rotary separator into which the blower deposits the dust and dirt from the polishing room. In this settling box we have a sprinkler head which took care of all three of these fires, so that the fires were completely extinguished before the fire department arrived from only eight blocks away. Both of our plants are completely equipped with automatic sprinkler protection. We think it is the best investment we have ever made. The net loss in these three fires was approximately $30. The net loss in man-hours of production is hard to estimate, because this would depend upon how successful we would have been in combating the blaze if it had not been for the sprinkler heads—but with the prompt arrival of the fire department, I would say that we would not have lost over 1000 man hours of production time."

Mr. Jim Shirreffs, President and General Manager,
S. & M. Lamp Company,
Los Angeles, California.

If Fire Had Not Been Extinguished, 12,800 Hours of Production Lost.

"A fire occurred in a fuel bin from unknown cause on May 11, 1942. One sprinkler operated and completely extinguished the fire. In view of the fact that our building is fireproof, the loss would not have been as great as it might have been due to this fire. However, figuring material loss, one-half of our raw material would have been despoiled and the man-hours of production, based on two months of suspended production which would have been caused if the fire had not been extinguished, 12,800 hours of production would have been lost. This production is on government orders."

Miss Rose Ganz,
Arrow Mill Company,
Los Angeles, California.

Without Sprinklers Would Have Lost a Week for all Three Shifts.

"Fire occurred on June 30, 1942, at the roof over a hot rolling mill. It was believed to have been caused by the ignition of soot and oil accumulated on the wood by the flaming oil on the hot roller. We can with complete assurance say that the operation of our sprinkler system did indeed confine our loss to almost a negligible figure in man-hours, and with equal assurance say that the loss in man-hours would otherwise have been serious. I can only guess at the probable loss which was averted, and that is about four to five thousand

man-hours. This is based on the probability that instead of losing only a few hours per man for one shift, we would have lost almost a complete week for all three shifts. Yes, and who knows, perhaps even much more."

F. A. Merliss, Assistant Treasurer,
United Smelting & Aluminum Company, Inc.,
New Haven, Connecticut.

Sprinklers Saved Considerable Money—Loss of Time—and Lots of Business.

"Since the installation of our sprinkler system, quite a few years ago, we have had several fires which convinced the writer, as well as others in the organization, that an automatic sprinkler system does do its work in a paint plant. It has saved us a considerable amount of money, loss of time, and no doubt lots of business. With reference to our fire which occurred on September 17, 1942, at a very early hour in pigment storage on the second floor of the main building, we can definitely tell you that the sprinkler system put out the fire entirely, and when the fire department arrived there was nothing much for them to do with the exception of cutting off the sprinklers. What could have been a large loss resulted in a small loss of approximately $1000. We would estimate that had it not been for the sprinkler system we would have suffered a man-hour loss of at least 10,000 hours—with as much as 50,000 man-hours. In view of the above, we unhesitatingly recommend automatic sprinkler protection to almost any industry that is interested in protecting their plant and, in the end, protecting their business."

Mr. Herman H. Shuger,
Baltimore Paint & Color Works,
Baltimore, Maryland.

Did Not Lose Any Working Time.

"A fire started on the back wall of our melting room during the night of March 5, 1942. Three sprinkler heads released quantities of water and smothered the fire before it had any chance to get a good start, and the actual dollar damage was less than $50, and we did not lose any working time. We feel that without sprinkler equipment this fire would have completely destroyed the back of our melting room before the local fire department could get here, and, in addition to the building loss we would have lost several thousand man-hours of production. To us a sprinkler system is our own private fire department, on watch twenty-four hours a day and the best means of protection buildings can have."

Mr. A. R. Taylor, Treasurer,
New England Brass Company,
Taunton, Massachusetts.

Without Sprinklers Would Have Been Out of Production Three Months.

"The fire at our plant on October 5, 1942, occurred in the elevator well and one sprinkler was sufficient to prevent a large amount of damage. Had this sprinkler not been in operation we have no hesitancy in saying that we would have been out of production for about three months with a possible loss of about 12,000 man-hours."

Mr. E. McWilliam, President,
Standard Thermometer, Inc.,
Boston, Massachusetts.

Sprinklers Save 80,000 Man-Hours.

Factory Mutual Record.

The Berkshire Fine Spinning Associates mill in Fall River, Massachusetts, credits a few sprinklers over their switchboard with saving 80,000 man-hours of production.

A fire in the picker room shorted some power cables. This opened an oil circuit breaker at the main 600-volt switchboard. A short time later a plant electrician — unaware of the burned picker-room cables — closed the breaker. A violent explosion immediately ruptured the breaker casing and showered burning oil over near-by switchboard equipment; but there was no further electrical disturbance.

Twelve sprinklers over the board opened and controlled the fire, which threatened to involve insulation on all the cables and oil in the other breakers. Thanks to these sprinklers, damage to the switchboard and massed cables was confined to a small area. Without the sprinklers the board would have been very seriously damaged if not totally destroyed, and even under the best replacement conditions, with cables and switches readily available, the plant would have been shut down for at least a week, which would mean some 80,000 man-hours loss in addition to the three and one-half days already lost. Because of present-day difficulties in securing replacements, it is even more likely that three or four weeks' production would have been lost.

100,000 Man Hours of Production Saved by 9 Sprinklers.

"The fire which occurred on October 20, 1942, from a hot bearing on the lineshaft of the elevator head, was extinguished by the operation of nine sprinklers. On our present basis of operation our estimated man-hours of production will run from 90,000 to 100,000 for the year 1943, exclusive of office and sales force. No doubt this would all have been lost, as we think the fire would have been a very serious one if it had not been for our sprinkler system."

Mr. Frank G. Wallace,
Waggoner-Gates Milling Company,
Independence, Missouri.

Would Have Lost Production of 200 Men for Six Months.

"Fire occurred from unknown cause in Building No. 2 and was extinguished by the operation of three sprinklers. If destruction had been complete we would have lost production of 200 men for six months, or as long as it would take for replacement of facilities."

American Wire Fabrics Corporation,
Mount Wolf, Pennsylvania.

"We Have Great Belief in the Sprinkler System for Minimizing Fire Losses."

"On August 13, 1942, fire started in the machine shop from the overheating of quenching oil. One sprinkler entirely extinguished the blaze. Due to the location of this fire, the construction of building and the height of the roof, we believe that forty man-hours saved would be a maximum due to sprinkler system. The sprinkler operation pleased us and showed us its value. Next time in a different location our possible loss would be a much greater estimate. In other words, we have great belief in the sprinkler system for minimizing fire losses."

Mr. S. C. Cheney, President,
S. Cheney & Son, Gray Iron Founders,
Manlius, New York.

If Fire Had Not Been Controlled Would Have Lost Plant.

"The fire which occurred at our plant on February 1, 1942, was the result of a gas explosion. The fire damage, probably due to the fact that we did have sprinkler protection, was negligible as compared with the damage caused by the force of the explosion. If the resulting fire had not been controlled, we could have lost our plant. This, in man-hours of production, would have been rather high, as at that time we were averaging approximately 150,000 man-hours per month."

Mr. Johnston B. Shimer, Superintendent, Wellsboro Division,
Corning Glass Works,
Corning, New York.

Fire in Spray Booth Controlled With Only $114 Damage.

"On July 9, 1942, while Fire Inspector Neitz of the Plant Protection Department was making his regular tour at 5:30 P.M. in Plant No. 4A of the Mack Manufacturing Corporation, his attention was called to a fire by an

employee of the enameling department. There was a fire in the spray booth caused by spontaneous ignition in the paint residue. This fire opened seven automatic sprinkler heads in this area, and with the aid of a two and one-half inch hose stream manned by plant patrolmen, the fire was extinguished with only $114 damage. Had there been no automatic sprinkler system the enameling room at least would have been destroyed with a loss of approximately 800 man-hours, not counting the expense of rebuilding the same. The plant patrol, being trained, shut the indicator valve when sure the fire was extinguished, thereby obtaining a minimum of water damage."

Mr. P. J. Dorr, Supt., Plant Protection Department,
Mack Manufacturing Corporation,
Allentown, Pennsylvania.

Fire Extinguished by One Sprinkler.

"Fire which occurred in a small pile of dry enamel sweepings was extinguished by the operation of one sprinkler. Inasmuch as the fire originated in our paint shop there could have been very considerable damage done, and there is the possibility of the lost man-hours which could have amounted to approximately two hundred hours, which would have placed us in a rather serious position."

Mr. R. Moyse,
Wheeler Reflector Company of Canada, Ltd.,
Toronto, Ontario, Canada.

Sprinkler Prevented Serious Curtailment of War Production.

"Fire broke out during the night of August 3, 1942, the cause apparently spontaneous ignition from rags that were inadvertently thrown in a paper bale bin. By good fortune they were directly under a sprinkler head, which let go and quickly put the fire out before it had spread. It took perhaps ten people the better part of the next day to clean up. But the sprinkler very effectively made a minor affair out of something which might have been a very serious loss and curtailment in our ability to continue manufacture of war materials. The 80 man-hour loss in cleaning up was probably but a fraction of what we would have lost if the sprinkler had not been there."

Mr. F. J. Bush, Jr., Vice-President & General Manager,
Puritan Company, Inc., Automotive Division,
Rochester, New York.

Sprinkler Extinguished Blaze Before Anyone Realized There Was a Fire.

"The fire in our plant, to which you refer, occurred on January 15, 1942, during working hours, when hot lead ignited burlap bags. It might just as well have broken out during the night. It is rather difficult to estimate the man-hours of production that might have been lost; let it suffice to say that it is highly probable that without sprinkler protection the entire building could have been lost. As it turned out, the sprinkler operated, extinguishing the blaze before anyone in the building realized a fire had started, and our loss was negligible. We do feel strongly that all sprinkler systems should be supervised carefully, preferably by mechanical water flow or air pressure alarm through a

central station. The one fact alone that a sprinkler system properly supervised is on duty twenty-four hours a day, whether the plant is open or closed, protecting machines and buildings that cannot be replaced today, should be answer enough for anyone who questions the advisability of installing such protection."

Mr. Karl Fischer, Vice-President,
National-Boston Lead Company,
Boston, Massachusetts.

Without Sprinklers There is No Telling What Damage Might Have Been Done.

"A flash fire of coal dust occurred at the Irwin foundry on November 18, 1942. The fire was controlled through sprinkler operation until the arrival of the local fire department, and certainly if we hadn't had the sprinkler protection the fire would have spread to a larger area and given the fire department a much larger conflagration to deal with. Our plant was busily engaged in producing products used exclusively in essential industry serving the war effort, and at the time of our fire we were about two weeks behind in the filling of incoming orders. The fact that our actual loss was small permitted us to resume productive operations within a few days. Without the sprinkler protection there is no telling what damage might have been done to our machinery and equipment which might have taken a very long time to replace under existing conditions."

Mr. James H. Whitehead,
Penn-Rillton Company, Foundry Facings,
New York, N. Y.

Loss in Money Was a Minimum and in Man Hours of Production Nil.

"Fire occurred in a storeroom on March 13, 1942. Our plant is made up of a ramification of one-story steel and frame constructed buildings connected in such a manner as to practically constitute a single unit. The location of the fire in question in relation to these buildings makes it difficult, if not practically impossible, to anticipate or even surmise what might have happened had the sprinkler system not responded promptly and effectively, but it is not unlikely that, had the fire not been checked and extinguished in its infancy, the operation of the plant would have been greatly retarded if not completely destroyed for a very considerable period of time. As it resulted, the loss in money was a minimum, and in man-hours of production nil."

Mr. W. Schweppe, Plant Superintendent,
Franklin Glass Corporation,
Butler, Pennsylvania.

Sprinklers Saved Building During Construction Period.

"The fire occurred in a small lean-to office portion of the building on May 1, 1942. Three heads fused, partially extinguishing the fire. Fire occurred during the construction period, before the building had been turned over to the Douglas Aircraft Company, Inc., for occupancy. This being such a small building, we can only estimate the entire loss, which we believe to be less than one thousand man-hours."

Mr. D. A. Davidson, Chief of Plant Protection,
Douglas Aicraft Company, Inc.,
Long Beach, California.

Sprinklers Prevented Very Serious Fire.

"We were having an outside painting concern remove excess paint from the ceiling in our raw stock room when the fire occurred on October 29, 1942. They were using an inflammable type of paint remover. One of the painters smashed a burning light bulb with his elbow and immediately a space approximately 40 feet square burst into flames, and drop cloths which were protecting stored material caught fire. Approximately 14 sprinklers operated and extinguished the blaze before the fire department arrived. This would probably have resulted in a very serious fire if the sprinkler protection had not been available."

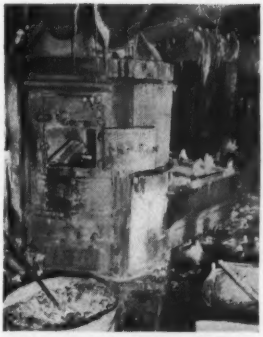
Mr. W. H. Rietz, Vice-President,
Ilg Electric Ventilating Company,
Chicago, Illinois.

We Do Not Believe Any Plant Can Afford to be Without Sprinkler Protection.

"On January 17, 1943, fire occurred in and around a sawdust bin in the basement. The fire was quickly extinguished by twenty-seven sprinklers, which kept the loss to a very low figure. In the particular building where the fire occurred are employed approximately 250 people. Without the automatic sprinkler protection it would be difficult to say what might have happened. However, as this fire occurred at a time when only the guard and watchman were on duty, there is a possibility that the entire plant would have been rendered unserviceable for some time. This would automatically curtail work in another plant we have one block away with approximately 250 more employees, inasmuch as the operations at one plant dovetail with those of the other. Then, too, we are doing a lot of subcontract work, and this would have meant that our prime contractors would have suffered in not getting the parts to complete their assemblies, which would probably result in a temporary layoff on their part. It might also have had some effect on other subcontractors, for a loss of production from us would mean that they would not be able to complete their assemblies, and would not, therefore, require the volume of production they had coming in from other subcontractors, and it would probably have slowed them down until we were again in production. We are extremely happy and most fortunate in having averted a serious fire through the use of automatic sprinkler protection. We do not believe any plant can afford to be without this protection, especially at a time like this, when loss of man-hours so seriously affects our war program and our national safety."

Mr. W. L. Pierson, Executive Vice-President,
O. F. Mossberg & Sons, Inc., Manufacturers of Firearms,
New Haven, Connecticut.

Cardboard Duct Costs Eight Lives.



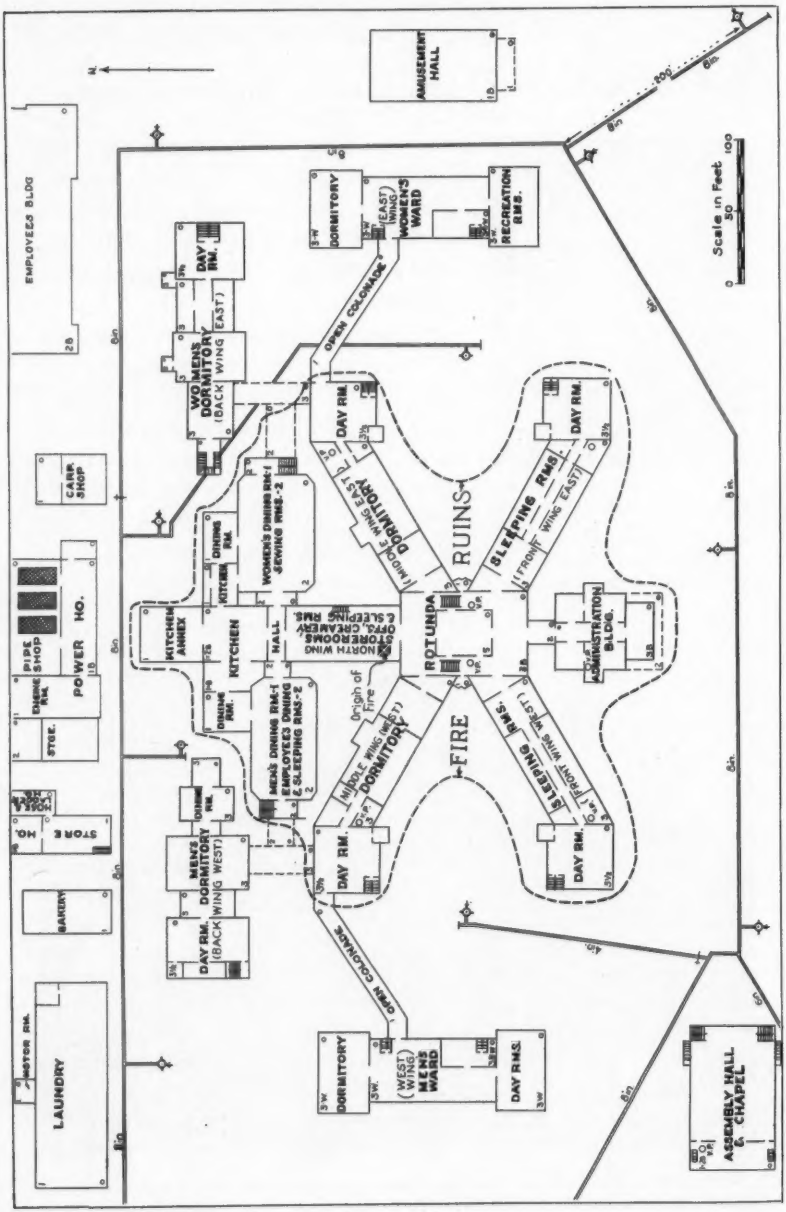
The furnace pictured above ignited a cardboard return air duct from the first floor hallway of an Augusta, Maine, rooming house and resulted in a fast-spreading fire which claimed eight lives.

Five men, two women and a six-year-old boy were burned to death when fire broke out in the early hours of the morning of February 16, 1943, and severely damaged a three-story wooden rooming house in Augusta, Maine.

The blaze originated in the basement when a furnace set fire to a cardboard air duct attached to the cold air box at the back of the furnace. The flames traveled swiftly through the duct to the first floor. Augusta firemen, responding from their station only two houses away, found the entire building in flames. They were further handicapped in their fire fighting and rescue work by the severe cold.

Gardner Roberts.

This three-story frame rooming house was gutted by fire, which broke out shortly after midnight on February 16, 1943.


EMPLOYEES BLDG
AMUSEMENT HALL
DORMITORY
(EAST WING)
WOMEN'S WARD
RECREATION RMS.
OPEN COLONNADE
DAY RM.
WOMENS DORMITORY (BACK) WING (EAST)
CARR SHOP
WOMENS DINING RM-1 SEWING RMS-2
DORMITORY (MIDDLE WING EAST)
RUINS
SLEEPING RMS. (FRONT WING EAST)
KITCHEN ANNEX
KITCHEN
HALL
NORTH WING STOREROOMS & SLEEPING RMS
ROTUNDA
ADMINISTRATION BLDG.
PIPE SHOP
POWER HO.
DINING RM.
STORE.
MENS DINING RM-1 EMPLOYEES DINING & SLEEPING RMS-2
Origin of Fire
DORMITORY (MIDDLE WING WEST)
FIRE
SLEEPING (FRONT WING WEST)
STORE HO.
MENS DORMITORY (BACK) WING WEST)
BAKERY
DAY RM. (BACK)
LAUNDRY
MASTER RM.
DORMITORY
(WEST WING) MENS WARD
DAY RMS.
ASSEMBLY HALL & CHAPEL
Scale in Feet
0 50 100

Evansville State Hospital Fire.

Report by Indiana Inspection Bureau
(Member N.F.P.A.).

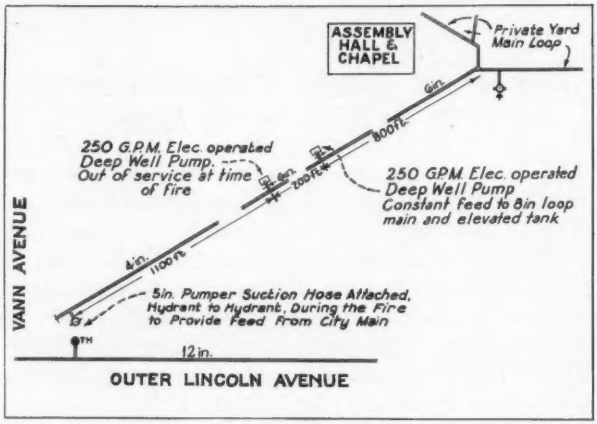
Fire, which occurred on February 9, 1943, brought death to two attendants and destruction to the huge main building at this state hospital for the insane. The most noteworthy feature of this fire was the evacuation of some 600 mentally unbalanced patients, many of them bed-ridden, without injury to any of them. This was possible only because of repeated exit drills. Although it has been stated that there was little resemblance to the regular fire drill in removing the patients, it seems beyond question that the fact that the patients' minds had been prepared for such an emergency was of incalculable value. It is not known how the two women attendants lost their lives, but they apparently became trapped in the building during rescue efforts.

Two possible causes of the fire have been advanced. It may have resulted from a short circuit in some old electric wiring in the attic of the north wing. There is also the possibility that the fire may have been caused by a cigarette, dropped hours earlier by an attendant, in one of the storerooms on the second floor. Whatever the direct cause of the fire, the extent of the destruction was due to the construction of the property with unprotected floor openings and huge fire areas, lack of adequate private fire protection facilities, and delay in calling the fire department. No insurance was carried on the buildings involved and an appropriation of $2,500,000 has recently been made by the state legislature for their replacement. Nearly all the hospital records kept in the administration building were destroyed.

Description of the Property.

This is a state-owned and operated insane asylum and hospital established in 1890 to serve patients legally residents of the nineteen counties in southwestern Indiana. The institution accommodated approximately 1200 patients, about half of whom were quartered in the four three-story wings of the main building. These wings, radiating from the 85-foot rotunda, together with the administration building, north wing, dining rooms and kitchen, constituted the main building, which was destroyed. This structure had substantial brick walls and heavy wood plank floors and roof throughout, and was in good condition. There were numerous interior brick partition walls, but no fire stops between sections on any floor. These interior walls also contained unlined heating and ventilating flues extending and communicating vertically from room to room from the basement, where the steam heating coils were located, to the attic, where the ducts ended.

There were four stairways, basement to attic, in brick shafts with heavy wooden doors on each floor. One was located in the extreme outer end of each


ASSEMBLY HALL & CHAPEL
Private Yard Main Loop
6in.
800Ft.
250 G.P.M. Elec. operated Deep Well Pump. Out of service at time of Fire
6in.
200Ft.
250 G.P.M. Elec. operated Deep Well Pump Constant Feed to 8in loop main and elevated tank
VANN AVENUE
4in.
1100Ft.
5in. Pumper Suction Hose Attached, Hydrant to Hydrant, During the Fire to Provide Feed From City Main
12in.
OUTER LINCOLN AVENUE

Layout of the water system.

of the four diagonal wings, but the rotunda was open from the first to the third floors. Other hall stairways in the administration building, north wing, dining halls and kitchen were entirely open. There were concealed spaces in the ceilings of the administration building and dining rooms, but otherwise the building was open finish throughout.

Electric lights, with wiring said to have been principally in metal conduit, had been installed by W.P.A. workmen during the past five years to replace the original installation. All wiring had not been replaced, however, and the remaining knob and tube wiring, including some in the north wing, where fire probably originated, was admittedly in questionable condition. Many lighting circuits were overfused.

Steam for heating coils located in the basement was supplied from a battery of three high pressure boilers in a detached power house. The basements and first floors of the various sections were mostly occupied as kitchen, dining rooms, supply storerooms, and recreation rooms; the second and third floors as sleeping rooms and dormitories for patients. Hazards incidental to cooking and maintenance features were well guarded. The attics are said to have been entirely vacant. Housekeeping was probably satisfactory.

Fire Protection and Water Supply.

According to the hospital engineer, first aid fire protection existing at the time of the fire consisted of chemical extinguishers and standpipes and hose, and would have been considered ample. There was no watchman service, but night supervisors were said to have made hourly rounds at night of all buildings in the main group. Automatic sprinkler protection was conspicuously absent. The water supply for the main group of buildings consisted of a

International.

Due to efficient fire drills, 1200 mental patients were safely removed when fire destroyed the Evansville State Hospital for the Insane at Evansville, Indiana. Two attendants lost their lives.

100,000-gallon tank elevated 115 feet above the ground, which supplied eleven hydrants located on an 8-inch looped main. The tank was supplied by two electrically operated deep well pumps of 250 g.p.m. capacity each, one of which was out of commission for repairs at the time of the fire. Electric current for pump motors was supplied from the institution's own power plant 30 feet north of the main building.

A 4-inch main approximately 1100 feet in length extended southwesterly to a private hydrant just inside the property line at Vann and Lincoln Avenues. This private hydrant is located 13 feet from a public hydrant on a 12-inch circulating main on Lincoln Avenue. Fire fighting equipment consisted of 500 feet of standard 2½-inch fire hose mounted on two village reels, a hand-drawn ladder truck, and nozzles, pike poles, crowbars, etc. Prior to 1942 the institution had maintained a well-trained fire brigade, but due to the loss of its former plant engineer, who had acted as fire chief, and to the unusual turn-over in help since the start of the war, no attempt had been made to maintain the fire brigade during recent months.

The four nearest companies of the Evansville Fire Department had visited and inspected the asylum, and definite plans of action had been agreed upon in the event of a fire. The first of these was that the first pumper to arrive should attach a 5-inch suction hose from the public hydrant to the private hydrant at the corner of Lincoln and Vann Avenues to provide feed from the

city main to the institution's water lines. Alarm to the Evansville Fire Department was by telephone only, and the local alarm for employees consisted of blowing the steam whistle at the power house.

Story of the Fire.

The fire is thought to have originated in either the attic or on the second floor of the north wing just off the rotunda. It was discovered by the women's night supervisor shortly before 2:00 A.M. on Tuesday, February 9. Neither she nor the men's night supervisor had noticed anything unusual on their last previous hourly check of their respective wards a short time before 1:30 A.M. They had then left the main building to check the hospital building located a short distance away. Returning alone, the women's night supervisor entered the rotunda shortly after 1:30 A.M., and after talking with an attendant on the first floor of the middle wing, passed through the hall of the north wing back to the kitchen. There she detected a peculiar odor and decided to investigate. Her investigation finally resulted in the discovery of dense smoke coming from one of the storerooms on the second floor of the north wing.

She claims to have cried an alarm and immediately ran down to the main office on the first floor, where she attempted to telephone the night engineer on duty in the power house, and the superintendent, who was asleep in his quarters on the second floor of the administration building. The superintendent was awakened at about 2:00 A.M. by the ringing of his apartment telephone. He could get no clear response when he answered the telephone, but sensed that something was wrong and hurried across the bridge passageway to the rotunda. On finding the north side of the rotunda and the north wing hall enveloped in dense smoke with flames starting to break through, he realized an attempt to fight the fire with the equipment at hand would be ineffective. He immediately issued orders to the employees then on hand to arouse all the attendants and evacuate the patients. The night engineer was sent to give the local alarm by blowing the steam whistle at the power house.

The evacuation of patients was by this time the sole consideration. The attendants, working under the direction of the superintendent, led and in some cases carried them from the building, beginning on the third floor and using the four stairways in brick shafts located at the extreme outer ends of the diagonal ward wings. Many of the patients had time to don clothing, but some of them went out into the winter night in their nightclothes and barefooted. They were shepherded to the greenhouse and other buildings not threatened by the fire and later removed to the chapel and to the hospital unit. The work proceeded smoothly due to efficient handling and to the fact that patients had for the most part become used to such evacuations through almost daily drills in leaving their wards for outside recreation. Patients generally remained calm and manageable.

Evansville Press.

A typical view of the ruins.

Under the pressure of the urgent task of evacuating the patients it seems that everyone had assumed that the Evansville Fire Department had been notified. The superintendent recalls issuing orders to someone to call the fire department, but the first call on record at the department's headquarters was received at 2:32 A.M., which was at least a half hour after the fire was discovered. Two 500 g.p.m. pumpers from companies located two and three miles from the scene of the fire arrived at about 2:38 A.M. A 5-inch pumper suction hose was immediately connected between the city and private hydrants at Lincoln Avenue to provide additional feed to the institution's private water system, and four hose lines were laid from the two pumpers which were connected to hydrants on the 8-inch private main. By this time the upper part of the rotunda and roofs of the various sections were burning fiercely.

While on his way to the fire the fire chief saw the flames and immediately called two additional 750 g.p.m. pumpers and ordered all off-duty firemen to report to the scene. A 1000 g.p.m. pumper was called a few minutes later. Eight pumper streams were used during the first half hour and the spread of the fire to the lower floors was slightly retarded. It was evident, however, that the main structure south of the dining rooms could not be saved, and the hose streams were concentrated on the dining rooms and on the east, west and back wings and connecting passageways to prevent their involvement.

The floors and the walls of the rotunda and diagonal ward sections soon collapsed, breaking the inside standpipes, and this large drain, added to that of the pumper streams, exhausted the water supply in the elevated tank in about one hour's time. With the resultant failure of streams from the pumpers attached to the hydrants near the laundry and back wing (east), it became impossible to stop the fire at the dining rooms, and these were quickly involved. When the tank supply failed all pumpers except one 500 g.p.m. were withdrawn. This engine, located at the hydrant near the assembly hall, continued to supply two hose streams, obtaining its water through the 4-inch and 6-inch main and 5-inch hose connection to the hydrant on the 12-inch city main. The 1000 g.p.m. pumper was then placed in operation at the large lake 600 feet south of the administration building, and this supplied three additional streams. Each of these five streams was supplied through 1200 feet to 1400 feet of hose necessary to reach the north side of the main group. The fire was under control about 6:00 A.M., with only slight damage to the back wing (west) and no damage to the new east and west wings, back wing (east) and power house. The 1000 g.p.m. pumper at the lake was not withdrawn until 5:30 P.M. It then replaced the pumper at the hydrant near the assembly hall, and two streams from this pumper were played on the ruins until 5:30 P.M. the following day. The Evansville Fire Department supplied five pumpers with a total pumping capacity of 3500 g.p.m., three ladder trucks including the aerial, 354 feet of ladders, 6050 feet of 2½-inch hose, 550 feet of 1-inch hose and 100 men.

Remarks.

This loss demonstrates once again that it is almost impossible to stop a fire in a combustible building having large unbroken areas without horizontal and vertical fire stops and lacking automatic sprinkler protection, once the fire has progressed beyond the incipient stage. The Evansville Fire Department did a commendable job in saving the adjoining buildings. The apparent thirty-odd minutes delay in notifying the fire department may have been a deciding adverse factor, but it seems probable that the fire had already involved the attics of the north wing and rotunda when discovered, in which case the delay did not greatly affect the final outcome. A larger and more dependable water supply would probably have made possible the stopping of the fire before it had penetrated either dining room.

The remarkable feature was the saving of the lives of all the patients. This brings forcibly to attention the importance of frequent exit or fire drills in institutions of this nature. It was under the instructions of the superintendent that almost daily evacuation drills were conducted for the patients when leaving their wards for outdoor recreation, and when the emergency arose there was little if any panic. It was fortunate, however, that the fire originated in the upper part of the building; had it originated in the basement the saving of the patients would have been much more difficult.

Memphis Industrial Fire Brigades.

By J. Albert Robinson,
Asst. Vice-President, McKesson & Robbins, Inc.

The fire department of Memphis, Tennessee, is believed to be the first in the nation to train companies of firemen at industrial plants to handle and use city equipment in emergencies. Each plant selects a key man to receive a three-week instruction course at the fire department, which has its own textbooks and equipment. This key man returns to his plant and organizes his company of fire-fighters among his employees. The program has been adopted by over 200 local Memphis plants. The first test staged by firemen in Memphis, and what is also believed to have been the first practical demonstration of the efficiency of such a brigade anywhere in the country, took place on October 14, 1942, at a seven-story down-town building occupied by the Van Vleet Ellis Division of McKesson & Robbins, wholesale druggists. The event was broadcast over the local station WREC and given publicity by *The Commercial Appeal* of October 14, 1942.

A fire alarm box was pulled at 9 A.M. by Mr. R. T. Thompson, member of the company advisory committee. It was sounded over WREC and rebroadcast over the entire building by the local sound equipment. A call for the assembly of the fire brigade was issued, with suitable instructions. Immediately afterward the evacuation chief specified exits through which employees should leave the building. In two minutes 200 persons were evacuated, with the exception of the switchboard operator, who remained on duty as would be the case in the event of a real fire. In the meantime, Pumper Company No. 9 was dispatched from its station at Front and Union Streets. Upon arrival at the scene of the assumed fire the firemen stood by and the three companies of the volunteer brigade took over and went into action.

Working in a smoke screen that simulated conditions of an actual fire, the three companies carried hose to the roof and to the second and third floors in a plan of action directed by the chief of the brigade and the assistant chief.

The smoke screen, supplied and handled by Major H. L. Stubblefield and Lieut. Thomas Forshaw of the Chemical Warfare Division of the Memphis Quartermaster Depot, was so handled that it permeated the entire building from third floor to roof, and created an effect so nearly real that other fire stations called headquarters, asking if a second alarm had been turned in, and a crowd looked on unaware that the smoke billowing from the windows was part of a practice drill.

No one knew that this smoke screen was to be used except officials of the Memphis Fire Department and Mr. Thompson. It was handled in this manner

During a fire brigade demonstration and test in a seven-story building in Memphis, Tenn., brigade members were given a taste of actual fire conditions when a smoke screen was laid throughout the building. The effect was so real that onlookers were unaware that the smoke billowing from the windows was part of a practice drill.

in order to see how the members of the fire brigade would conduct themselves under actual fire conditions. The question of possible panic among the employees was carefully considered and plans were made to avoid such a possibility. The smoke screen was timed to start at the same time the instructions to evacuate were issued. The smoke was located on the third floor and the roof. The only employees coming in contact with it on the roof were members of the brigade. By the time the smoke started spreading all of the floors above the third had been completely evacuated. Of course, the smoke permeated the entire building, but every employee was out before it even started spreading.

The three companies, each composed of a captain, lieutenant and four privates, performed every operation according to schedule, making the entire drill a complete success. Fire department officials had previously approved plans for the practice drill.

Vice-President McKay Van Vleet, Chief Executive of the drug house, concluded the broadcast of this event as follows:

"The entire drill was a complete success. Every operation was performed splendidly and according to schedule. The smoke screen, while lending color and excitement to the event from a spectator's viewpoint, gave our men expe-

Smoke, simulating conditions of a real fire, added realism to the drill. Care was taken to evacuate occupants before releasing the smoke bombs, to avoid any danger of panic.

rience that would prove invaluable in fighting a real fire. It was a wonderful example of teamwork and everyone was well pleased. All fire department officials present expressed their appreciation of the splendid work done, and stated that it was all that could be desired."

The brigade consists of three companies, six men to each company, consisting of a captain, a lieutenant and four firemen. All members are volunteers and all work is done on their own time. These companies are organized exactly along the lines of the local fire department. In addition to these three companies there is a chief and an assistant chief, also an advisory committee consisting of two members. All were trained by two members of the local fire department, and after finishing their basic training they decided upon a regular program of training to be followed. The third Saturday in each month all three companies go up to the main fire station and go through the various fire-fighting evolutions in the training tower, and regular fire hose and equipment are used. The work on these occasions is supervised by one or more fire department officials on duty at that time.

On Tuesday night preceding the Saturday drill, the brigade members meet at a local hotel, have dinner, "fight fires" around the table, and plan their campaign for Saturday. They may also have members of the fire department as guests, who will talk with the group regarding their problems.

In addition to this program, once a week each company assembles at the command of its company captain and makes a trip up and down the fire escape to keep in practice.

In connection with and part of the fire brigade there is an evacuation organization consisting of an evacuation chief with a lieutenant on each floor. These men have complete plans for any type evacuation necessary.

It is felt that this pioneer movement on the part of the Memphis Fire Department is well worth emulation and that industrial executives in other cities should encourage their local fire departments to co-operate in developing similar co-ordinated and professionally trained fire brigades.

Albers Bros. Milling Co. Fire.

A huge wooden waterfront warehouse 840 feet in length without fire stops, without automatic sprinklers, remote from public fire protection, but so located as to seriously expose a large concrete mill and elevator structure, was the locale of a fire loss estimated at upward of $3,000,000 when fire, on February 28, 1943, destroyed the Albers Bros. Milling Company plant at Oakland, Calif. Located in what is known as the "Outer Harbor" on city-owned waterfront property, this plant could be approached from the mainland only by a 1½-mile long dead-end road. When flames from the burning plant lighted the Sunday evening sky, crowds of motorists rushed for the fire, slowing the arrival of fire fighters. Two hydrants on a long dead-end 8-inch main gave the only convenient water supply for fire fighting purposes.

Description of Property.

The huge wooden warehouse covered a ground area of 119,900 square feet. It was one to two stories, with height varying from 30 to 48 feet. The roof was tar and gravel on wood sheathing, the second floor was of wood, and the first floor was of asphalt surfacing on 3-inch plank. Approximately 50,000 square feet of the warehouse was over tide water. Occupancy of this building was chiefly grain storage. The warehouse was a U-shaped structure which, on three sides, surrounded concrete mill and grain tank buildings of the same plant.

The mill and grain tank structure was a semi-fire resistive building 6 to 8 stories and basement in height, and covered a ground area of 14,500 square feet. The walls were 6-inch concrete curtain. Floors were 6-inch concrete slab with hardwood surface. The roof was concrete slab surfaced with tar and gravel. The building frame was of concrete columns and beams. Elevators and stairways were enclosed with concrete and cut off at each floor with suitable doors. However, man lifts located in different parts of the mill were not enclosed or cut off at floors. A great number of pipe openings cut the

San Francisco Chronicle.

Some indication of the magnitude of the Albers Bros. Milling Company fire may be gained by comparison with the San Francisco fireboat shown wetting down the ruins at the right. This vessel has a hull 120 feet long. The smaller craft at the stern of the fireboat is one of two U. S. Coast Guard fire fighting units operating at this fire. The streams from these smaller fireboats proved inadequate to cope with a conflagration of this magnitude. The concrete mill and grain tank building shown standing in the ruins was surrounded on three sides by a huge wooden grain warehouse which was 840 feet long and 165 feet wide.

San Francisco Chronicle.

A soldier stands guard at the entrance to the Albers Bros. Milling Company plant at Oakland to keep back spectators who reportedly blocked the only road to the fire and delayed some of the fire fighters. In the background flames may be seen sweeping through the huge wooden warehouse. At the left are several large molasses tanks operated by the company.

various floors. Exterior wall openings overlooking the warehouse were protected by non-standard metal frame wired glass windows. Interior communications between the warehouse and mill consisted of numerous doorways, pipe and conveyor openings. The doorways were protected by double automatic labeled fire doors. The other openings were unprotected. This section was occupied for cereal milling, grading, grinding, mixing, roasting and storage of grains.

Story of the Fire.

The origin of the fire is unknown. Careless smoking or spontaneous ignition are considered probable causes. It was first observed near the ladies' restroom on the mezzanine floor of the warehouse near the east or shoreward end of the building. The plant was completely covered by an approved compulsory tour watchman service. At 8:17 P.M. the watchman was in the immediate vicinity of where the fire is supposed to have started but observed no evidence of fire while in the warehouse. Upon continuing his rounds, and while on the fourth floor of the Mill Building, the watchman heard breaking glass. His investigation disclosed fire coming through the roof of the warehouse. He pulled a manual alarm at 8:32 P.M. and continued on his rounds. At the sixth floor he pulled another manual alarm which registered at 8:34. Continuing on his route he pulled a manual alarm on the second floor at 8:41.

The fire department received the alarm at 8:33 P.M. and the first company arrived at 8:37 P.M. The fire was then in the east end of the warehouse, as described by the watchman. Another fire company arrived at 8:38 and went to the west end of the warehouse, which was not then involved. However, three or four minutes later the entire warehouse was aflame. The sixth alarm, bringing the entire fire department, was sounded by the chief at 8:41 P.M. Nine engine, four ladder, one chemical and one floodlight companies fought the fire, aided by a San Francisco fireboat and two small Coast Guard fireboats.

The extreme rapidity with which this fire spread indicates that a flash fire occurred due to accumulated dust, although there was no evidence of actual dust explosions. The fire spread to the concrete Mill and Grain Tank Building through many wall openings. It is not certain that all fire doors operated properly. Wired glass windows overlooking the warehouse were practically of no value, due to the intense exposure which melted the glass out of the frames. The spread of the fire inside the Mill Building was very rapid due to many unprotected vertical openings, such as man lifts, spouts and conveyors. This structure was severely damaged, as well as its equipment, machinery and stock. The warehouse was almost a total loss.

Last Days of Penang.

It is now possible to lift, to some degree, the veil which fell over Penang following its occupation by the enemy. That there was unpreparedness, marked by muddle and indecision, on the part of the civil power, there can be no doubt; but, one redeeming feature was indubitably the work of the municipal fire brigade, under Chief Arthur J. Brown. This comparatively young but highly experienced fire officer extracted the maximum of effort from the various races whom he led and encouraged throughout the enemy attacks on the island; and he remained at Penang until it was impossible to do any more to thwart the will of the enemy.

Once the enemy was established in Indo-China the civilian administration in Penang began to display a little more interest in civil defense. This revival of interest culminated in a grand review by the Governor of the volunteer force, the local defense corps, the pioneer corps, and the following civil defense organizations: fire service, police, ambulance workers and air raid wardens. Quite a spectacular and somewhat impressive display, and plenty of martial music and flags.

This report, abstracted from "Fire," the official journal of the British Fire Service, presents an interesting picture of the fire fighting in Penang during the fighting on the Malay Peninsula prior to the fall of Singapore. The British terminology should be familiar to most readers. A "turntable ladder," to the American and Canadian, is an aerial ladder. An "appliance" is any piece of motor fire apparatus. A "branch" is a nozzle. AFS is the abbreviation for Auxiliary Fire Service.—ED.

Penang's Firefighters.

The fire fighters were about 700 strong; they comprised the regulars of the fire brigade and the Auxiliary Fire Service (clad in overalls and generally equipped according to British AFS standards). The mental and the physical standards of these auxiliaries were not high, due to the local belief that manual work is essentially the preserve of the illiterate coolie.

The majority of the AFS consisted of coolie laborers and messenger boys of a variety of races, and, seemingly, incapable of learning to march in step. The rescue squads were even worse, mainly Tamil coolies without uniform and without boots; most of them bolted.

The municipal fire apparatus was exceptionally good. It included the latest types of limousine motor pumps, a turntable ladder, about 11 other major appliances and a mobile canteen with 30 European women in attendance.

The regulars also designed a two-man manual pump, constructed almost entirely of wood, for the defense of business premises, and made dozens of collapsible branchholders. Incidentally, the brigade produced a training manual for all ranks.

Water supply was a difficult problem. The authorities regarded any useful project, such as sea water mains, as "costing too much"; the water department had no means of quickly repairing damaged mains; and there was no system of static water supply, such as tanks. Fire-watching had not emerged from the paper stage.

Dual Control.

On top of all this was dual control. The Government controlled the AFS, and the municipality the fire brigade, with the result that Penang had two separate fire-fighting organizations. The director of the ARP was in full command of the AFS, with power to direct fire appliances here and there.

The Government, too, proved to be a better employer than the municipality. It paid its auxiliary firemen more and worked them less than did the city, and made them eligible for compensation which was rigorously denied to the regulars. In fairness to the civil administration, it must be said that the military administration had gone to considerable lengths to emphasize the remoteness of the possibility of aerial attack on Penang.

The Storm Breaks.

Then came the storm. Within three days of the surprise attack on Malaya, Japanese forces were beginning to close on Penang. The air raids, carefully co-ordinated with the land offensive, were concentrated on a congested area less than a mile square, within which were stored thousands of tons of rubber, carbide of calcium, matches, fireworks, oils, timber, copra, petrol, sugar and, also, most of the foodstuffs for the population of about 200,000. There were no military objectives.

Narrow streets, formed by closely packed, open-fronted native brick buildings, giving a high ratio of roof covering to open spaces, made it impossible for a bomb to be ineffective. Many of the bombs were explosive incendiaries.

The first attack, by 27 Japanese bombers, in tight V formation of threes unloading their bombs simultaneously, inflicted grievous casualties on the people in the streets. The exact number of killed and wounded may never be known; many of the dead were still lying in streets and alleyways when the evacuation began. The hospital, with more than 1000 beds, was filled to overflowing by the wounded civilians.

One thing is certain, the Penang Fire Brigade and AFS suffered extremely heavy casualties, possibly the most severe of any branch of the civil defense forces. The enemy made a principal target of the central fire station, which, with its equipment, especially hose, was heavily damaged; another fire station was completely destroyed. The brigade's petrol store also suffered.

All ranks fought the fires, and despite bombs and machine-gun bullets, which took toll of the personnel, did much to check spread of fire. The work of the fire fighters was considerably hampered by fractured mains and residents fleeing with their furniture loaded into rickshaws or in hand carts.

Rumors of all kinds were assiduously disseminated by fifth columnists, but none could persuade firemen to leave their posts. These firemen worked throughout the night, with hordes of rats and hungry dogs attacking the bodies of the dead lying on the ground. Gangsters and looters, in the absence of the soldiery and the police, held sway.

Had Penang been reasonably defended by airplanes and anti-aircraft artillery the fire-fighters would have succeeded. As it was, they were throughout at the mercy of bomb and machine gun bullets from the Japanese aircraft.

The water department did its best to maintain supplies for fire extinction purposes; it repaired some of the mains, but the volume of water coming through was small.

To Singapore.

Then came news that the armed forces had left Penang. This was followed by orders to Chief Brown that fire-fighting operations were to cease, particularly as the troops before embarking had fired a number of buildings. The fire fighters thereon salvaged as much food as possible for the population.

Then came orders for all officers and other ranks to try to reach Singapore in the best manner they could. Wherever they may be now, this fact remains —that all those who lived through those last terrible days of Penang can never forget the great bravery and unflagging devotion to duty displayed by the fire fighters, of all grades, of Penang.

Safeguarding Gas Appliances.

By F. E. Vandaveer, Assistant Director,
American Gas Association Testing Laboratories.

Long before the second world war started and everyone became acutely conscious of destructive fires caused by incendiary bombs, many organizations had been constantly striving to prevent fires and reduce loss of life and property. "Safety first" had become a battle cry in nearly every line of endeavor. The American gas industry was among the leaders of this movement. With such a background of experience in promoting safety in peace time, and with records from allied countries' experiences in war time also available, the gas industry, through the American Gas Association, has organized to combat the menace of fire.

In this article it is proposed to deal with only one phase of this organized effort, namely, insuring of safety from the fire hazard of gas appliances. As each residential fire increases the already acute housing shortage, their prevention becomes of more importance than ever before. It is also intended to present:

(1) The record of reduction in fire losses attributed to gas and gas appliances during the past 17 years.

(2) A brief résumé of American Standard approval requirements which insure greater safety from fire hazard.

(3) Improvements in test equipment and procedure permitting test results more representative of actual field conditions.

A correctly designed and properly installed gas appliance which meets American Standard approval requirements is not a fire hazard. Rather, it represents the safest type of heat-generating equipment in common use in the home today. Records of the National Fire Protection Association, the National Board of Fire Underwriters, and Government statistics demonstrate the correctness of this statement. Reference to Fig. 1 will reveal that with an increase of several million users of gas in the past 17 years the fire loss attributed to both gas and gas appliances has steadily decreased. While figures are not available on fires attributed to gas appliances alone, it is reasonable to assume that only a fraction of fires reported are traceable to gas appliances.

This achievement, despite an increase in number of users, as well as the growing tendency to set appliances closer to walls and floors, and to adapt their design to built-in modernized house constructions, has been the result of intensive planning by the American Gas Association and coöperation from many other sources. All organizations engaged in fire protection and participating in educational work along these lines, such as the National Fire Protection Association, National Board of Fire Underwriters, city fire departments, and

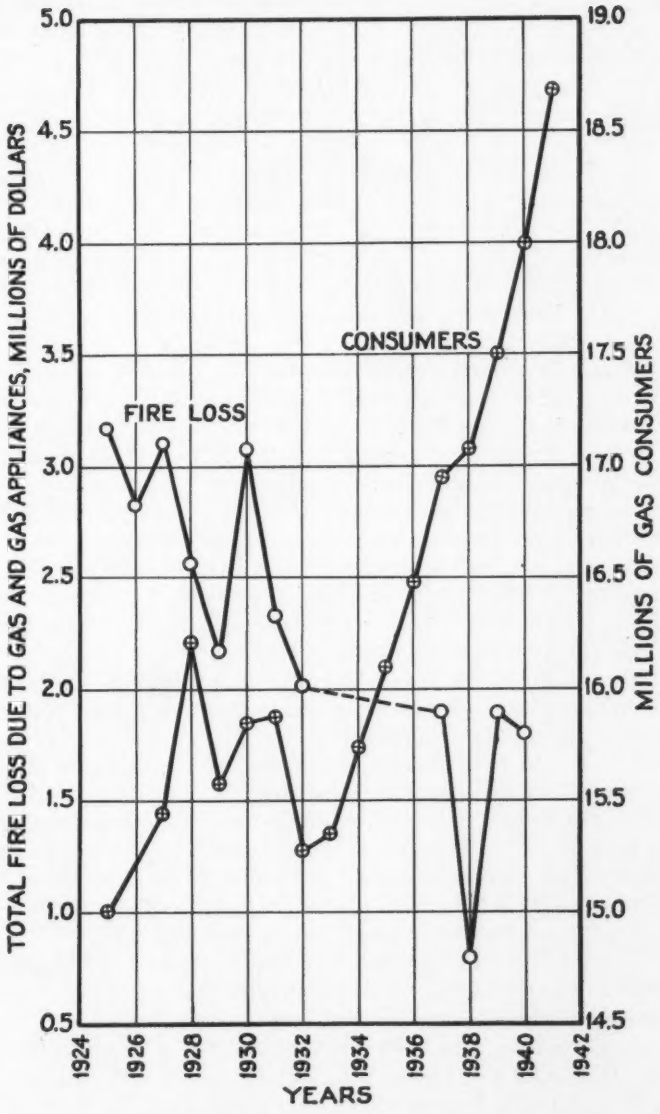


Fig. 1. Decrease in fire losses attributed to gas and gas appliances with increase in number of gas consumers for the period 1925-1941.

many others, have contributed. Manufacturers of appliances have been especially diligent in designing and constructing safe gas-burning equipment. A most effective contribution has been made, however, through the American Gas Association's gas appliance and accessory testing and certification program. Every one of its 25 requirements committees has included detailed tests and limitations on all items pertaining to fire hazard in the standards they have prepared. It has been their intent to insure that approved gas equipment provides adequate protection from all possible causes of fire within the appliance itself. From time to time, as the situation permits, new requirements are added and old requirements are strengthened to insure still further safety from fire. Within the past 12 years many improvements in this direction have been made so that the fire record on gas appliances should continue to improve as more new models are put in service.

Research data on which new requirements have been formulated and existing ones modified have been supplied by the American Gas Association Testing Laboratories. In addition, these Laboratories, established 17 years ago, rigidly enforce these requirements. For many years over 95% of all domestic gas-burning appliances manufactured and sold in the United States have been tested and approved by this organization. At present, more than 18,000 basic models of domestic appliances are listed as approved. Requirements for such equipment sponsored by the American Gas Association are nationally recognized as American Standard by the American Standards Association. Over 200 municipalities now have ordinances permitting only approved gas equipment to be installed within the limits of their jurisdiction.

The basic objective of the gas industry in establishing the A.G.A. Testing Laboratories was to insure manufacture and sale of safe gas appliances. This included not only safety from fire hazard, but many other features as well. Its approval seal placed prominently and permanently on approved equipment reads, "Complies with national safety requirements."

The success of this program in reducing fires warrants closer study of how it was accomplished, the requirements imposed, and the type of tests conducted.

It has been recognized that a fire hazard may be created by gas appliances in any of six ways. At least these possibilities may exist and should be considered in making a gas appliance as nearly foolproof as possible.

1. Escape of unburned gas into the room, with subsequent ignition.
2. Explosion within the appliance itself, causing flames to flare out and ignite flammable material.
3. Location of flammable material too close to an appliance.
4. Excessive temperature of flue gases leaving the appliance.
5. Excessive temperature of heated air leaving the appliance.
6. Improper location of an appliance with respect to surrounding walls or floors.

Fig. 2. American Gas Association Laboratories Approval Seal.

American Gas Association requirements committees, aided by data from their Testing Laboratories, have prepared requirements as rapidly as convenient to minimize all of these factors.

The possibility of unburned gas escaping and igniting has been minimized in different ways, according to the type of appliance involved. For several years it has been mandatory that every gas boiler, furnace, unit heater, and refrigerator, as well as every automatic water heater, automatically or remotely controlled floor furnace, and automatically lighted gas range oven or broiler shall be equipped with an automatic pilot (safety pilot) which will shut off the gas to the main burner in the event of pilot extinguishment. On all such appliances for gases heavier than air, as for example propane and butane, it is required that this device also shut off the gas to pilot burners. Where applicable, mandatory provisions on automatic pilots are included in requirements for all other appliances. Another safeguard used on gas ranges is that oven and broiler valves are required to be "self-latching" in the "off" position. Such valves which cannot be turned on accidentally or deliberately by children are also available for top burners. In addition to these mechanical devices many other performance tests tending to reduce possibility of escape of unburned gas even in small volumes are enforced. These include requirements for prompt ignition from a pilot, rapid burner-flame travel, protection of flames from chimney drafts by means of a draft hood, and shielding of pilots from room drafts.

Not only have automatic pilots been made mandatory, but the improvement in their construction in recent years has been remarkable. They will

Fig. 3. Three special ovens in which automatic pilots are tested for operation at temperatures of 400, 600, 900, or 1200° F., depending upon manufacturer's specifications, and below, a group of 14 typical automatic pilots used on contemporary gas appliances.

operate to open or to close off the gas supply much more rapidly than was considered possible only a few years ago. American Standard Listing Requirements for Automatic Pilots have been prepared and most pilots now in use comply with them. Substantial and durable construction is demanded, and performance tests for leakage, capacity, and continuance in open position, as well as most practical and difficult life tests of 100,000 cycles of operation and checking time of operation to open and close off gas supply at various specified combustion chamber temperatures ranging from 400° to 1200° F. are applied. Allowable time of operation has been reduced from ½ to 1/3 of that formerly required. Many pilots will act to close off the gas supply in case of pilot outage within a few seconds of the time the gas is extinguished. A group of automatic pilots and the high-temperature ovens in which certain performance tests are conducted are shown in Fig. 3.

Another major factor in maintaining the high standard of safety from fire is the periodic inspection of approved appliances and listed accessories at the source of manufacture by Laboratories' inspectors. In Fig. 4 an inspector is shown in foreground checking dimensions of automatic pilots on one of the assembly lines of a large manufacturer of these devices. Visits are made once a year to every manufacturer to check over each piece of approved equipment, and once or more during the year at unannounced times to check production at that time. To retain American Gas Association approval or listing, construction at all times must comply with American Standard requirements and the Laboratories' records on the models originally tested and approved.

In addition to use of mechanical safety devices on the appliance itself, many gas companies are introducing an odorant into those gas supplies which are nearly odorless to warn users when gas is escaping unburned. Manufactured gas normally can be detected readily by smell, so odorants are added, where it is deemed necessary, only to natural, propane, and butane gases. It will, therefore, be evident from the above comments that real protection against escape of unburned gas is being provided in both the gas appliance and the gas supply.

What has been said concerning protection from escape of unburned gas is also applicable to prevention of explosions within the appliance itself. If unburned gas does not escape, explosions cannot occur. To guard against flames momentarily reaching outside the appliance on ignition, safeguards are also provided through application of special tests designed to cover this feature. Rigid tests on immediate and delayed ignition are conducted by the Testing Laboratories, using carefully selected test gases which are representative of those supplied throughout the United States and Canada, and at no time are flames allowed to flash outside the appliance.

The third possibility of location of flammable material too close to an appliance and its resulting ignition is also adequately provided for. In most gas appliances the burner flames are completely surrounded by metal combustion chambers, and they in turn are enclosed in one or more jackets frequently containing insulating material. On those room heaters employing open flames it is required that dressguards be provided so that flammable material cannot come in contact with the flame. Such a guard must give sufficient protection so that bond paper placed against it will neither ignite nor char through within a period of 10 seconds. Likewise, on room heaters a screen or shield is required underneath a heater if it is possible for incandescent substance to fall on any flammable material beneath the heater.

Limitation of flue gas temperatures is imposed on all vented gas appliances in such a way as to make them not only safe from fire hazard, but also highly efficient. The average temperature of flue gases is limited to not more than 550° F., with a definite test procedure using thermocouples for temperature measurements specified. On floor furnaces consideration must be given to the low position of flue outlet with respect to burner level and to overcome resistance in long horizontal flue pipe connections; therefore the temperature rise above room is permitted to be 530° F. It should be especially noted that this determination is made at the point where flue gases from the appliance enter the draft hood. At the draft hood outlet the temperatures are much further reduced by heat loss from the pipe and dilution with air drawn in through the draft hood relief opening. An investigation made at the American Gas Association Testing Laboratories on central heating boilers and furnaces showed that flue gas temperatures were reduced from 476° F. at the inlet of a draft

Fig. 4. In the foreground is an A.G.A. inspector checking construction of listed automatic pilots on an assembly line of the manufacturer.

hood to 345°F. at the outlet, or a drop of 27.5%. Flue pipe surface temperatures dropped from 258° F. before the draft hood to 187° F. after the hood, or a drop of 27.5%. These are typical results with a normal chimney draft. Most American Gas Association approved appliances do not approach the 550° F. limit for efficiency reasons.

The fifth possibility of creating a fire by discharging hot air at an excessive temperature from an appliance is avoided by making temperature limit and fan controls mandatory on so-called forced-air furnaces. These controls must be so adjusted that they will shut off the gas supply to the main burners before the air temperature in the furnace bonnet exceeds 250° F.* Tests are made at the American Gas Association Testing Laboratories to determine

*This is a maximum limit which would only be reached under some abnormal condition of operation (belt breakage, etc.), since under normal operation the maximum temperature of circulating air from forced-air furnaces is limited to 100° F. above room temperature.

Fig. 5. Typical temperature limit controls and arrangement of test apparatus for testing for calibration and sensitivity.

whether this requirement has been met and whether the limit control has been properly positioned and calibrated. Temperature limit controls are required to meet very rigid requirements for listing, including nine construction tests for substantiality and durability, and performance tests for dial calibration, sensitivity, varying voltage, and a life test of 100,000 cycles. A typical group of limit controls and the duct in which tests are made are shown in Fig. 5. Discharge air from gravity furnaces is limited to not more than 160° F. rise above room temperature. On floor furnaces the maximum spot temperature of discharge air may not exceed 350° F. rise above room temperature, this corresponding to an average temperature rise of approximately 200° F. On space heaters, bond-paper test is applied at the face of the outlet air grilles.

A sixth and last known possibility of fire resulting from operation of a gas appliance is its improper installation too close to surrounding flammable walls. Provision against this condition has been made in a number of ways with the idea that adequate protection from such an occurrence should be incorporated within the appliance itself. A great deal of study on proper limitation of temperature to insure safety from discoloration, charring, and ignition of adjacent combustible materials, as well as accuracy of methods of measurement, has been conducted at the American Gas Association Testing Laboratories. The remainder of this paper will reveal some of these data.

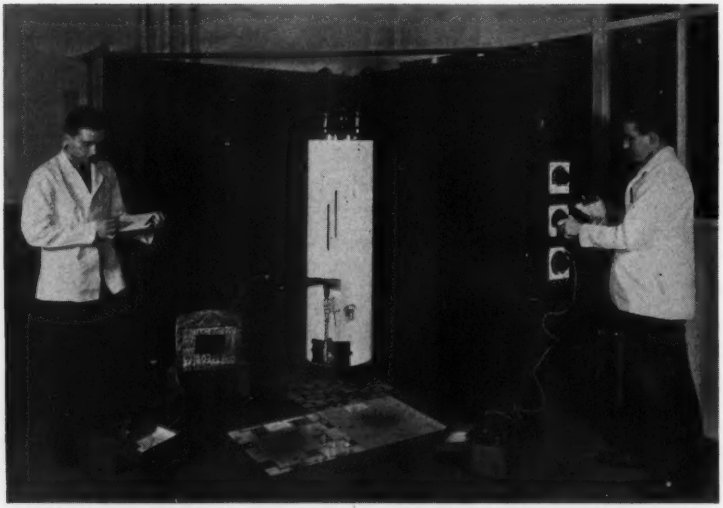


Fig 6. Arrangement of equipment for determining the temperature at which four different types of linoleum were affected by heat. Linoleum pieces were also placed inside the blackboard in front of the radiant heater.

American Standard approval requirements for various gas appliances state that the maximum temperature on walls located 6 in. from adjacent back and sides of the appliance and on the floor underneath shall be not more than 90° F. in excess of room temperature under conditions of test prescribed. Insulated ranges are set 1 in. from back and ½ in. from side wall; flush-to-wall type ranges are placed flush to the wall at both the back and side. On radiant heaters the temperature rise on the floor within 3 ft. is also limited to 90° F. Temperature readings are made at the end of one hour's operation at a gas pressure 1.5 times normal (1.25 for ranges).

In a previous study it was found that thermometers used for these tests should be standardized for length and width of mercury bulb in order to give comparable results. Since that time (1930) thermometers with mercury bulbs of 9/16 to 11/16 in. in length and 5/32 to 3/16 in. in diameter have been used. It was further shown in that paper that one hour was sufficient time to attain reasonable temperature equilibrium between the appliance and the wall. It was also demonstrated that very little difference in temperature is obtained with thermometers placed flush to wall surface or protruding ⅛ or ¼ in. through the wall. For standardization purposes it was decided to position the thermometers so they would project through the wall ⅛ in. Comparable results will also be obtained at any normal room temperature, indicating that on a temperature-rise basis equitable tests on appliances may be obtained in sum-

mer as well as in winter. It was also found that different floor materials gave widely varying results when thermometers were laid on them. On linoleum floor, for example, temperature in front of a heater averaged 8° F. higher than on concrete, and on wood they averaged practically 22° F. higher than on concrete. In order to insure results representative of field conditions, wood was selected for floor temperature tests. Floor boards used are of 1-in. tongue-and-groove oak flooring, painted with clear varnish and laid over 1-in, white-pine flooring with one thickness of building paper between.

The limit of 90° F. rise in temperature above room conditions with a 10% tolerance for experimental differences when using thermometers provides a good factor of safety from scorching and ignition of flammable materials. Ignition temperature data on flammable materials employed in construction of walls and floors are not readily available in published literature. In one in-

Table 1. Effect of Temperature on Scorching of Various Materials as Obtained by Method Described in Text.

Temp. ° F.	White Pine	Heavy Cotton Cloth	White Paper	Newspaper	Oilcloth	Painted Wood	Silk	Wool	Linen	Muslin
240	None	None	None	None	None	Slight softening	None	None	None	None
262	None	None	None	None	None	Slight softening	Slight brown	None	None	None
290	None	None	None	None	Tinged	Pimpled	Noticeable brown	Noticeable tint	None	None
300	None	None	None	None	Tinged	Pimpled			None	None
340	Tinged brown		Very light brown	Tinged	Light brown	Melted & pimpled			None	
350	Tinged	Light brown	Very light brown	Slight browning	Light brown	Melted & pimpled			None	
375	Light brown		Very light brown	Light brown	Brown	Melted & pimpled			Very light brown	
400	Brown	Brown	Dark brown	Brown	Very brown	Melted & pimpled				
450	Brown	Dark brown	Black	Dark brown	Dark brown					
500	Dark brown	Black	Charred	Charred	Black					

This table indicates that the lowest temperature for discoloration or noticeable softening of any of the materials tested begins at approximately 260° F.

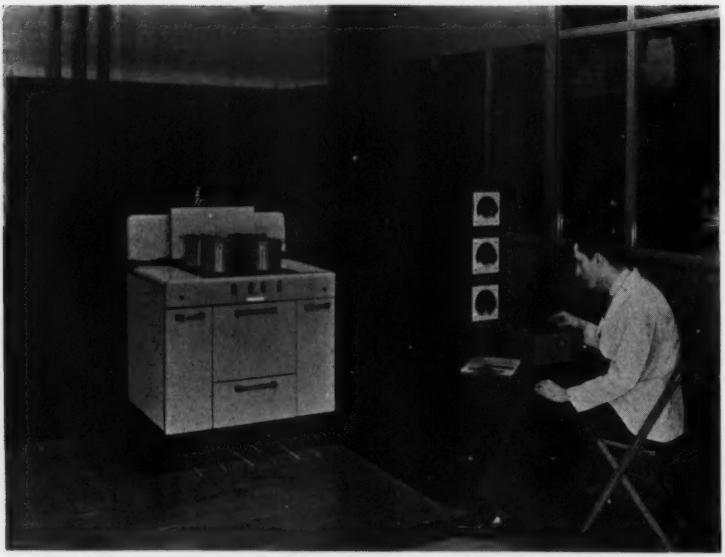


Fig. 7. Construction of a fire hazard test board with a range being tested flush to wall. Note at 6-inch intervals the thermocouple ends with discs attached and holes for thermometers alongside.

stance a handbook gives ignition temperatures of dry pine wood as 800° and of dry oak wood as 900° F. In another paper ignition points of several materials are listed as follows: white-pine shavings 406° F., white oak 410° F., newsprint paper 363° F., and cotton cloth above 840° F. It was further pointed out that the method of determination including weight of sample, air flow rate, and other factors must be considered in making use of these data. No information on scorching temperature of these substances could be found, but it is self-evident that this temperature would be less than the ignition temperature. Even though a fire might not be caused by excessive heating it obviously is not desirable to utilize appliances which may scorch or discolor wall or floor materials. Current American Standards have accordingly made provision for avoiding discoloration of walls and floors surrounding an appliance.

To determine the scorching temperatures of various wall and floor materials and cloth which might come in contact with hot surfaces, wood coated with ordinary paint, shavings of white-pine wood, paper, newspaper, oilcloth, silk, wool, linen, and muslin, were placed in a gas range oven thermostatically controlled, and temperatures registered by a recording pyrometer. The oven was a free air circulating type and very closely simulated open air conditions. The results obtained are shown in Table 1.

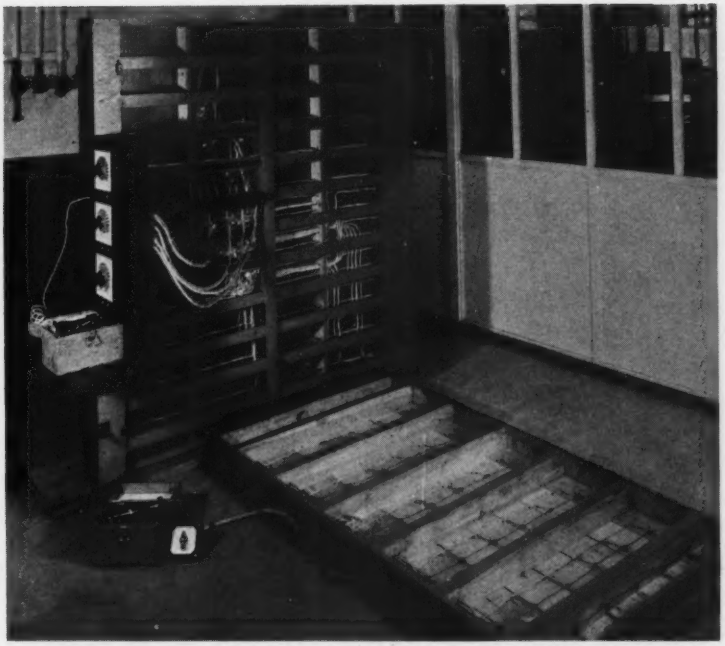


Fig. 8. View of back of one wall of the fire hazard board and bottom of the floor board, showing thermocouple wiring, plug-in jacks, plug sockets, and rotary switches.

Four different types of linoleum were also tested, for scorching and softening in normal room atmosphere in a manner shown in Fig. 6. Samples were placed on the floor under a water heater, and in front of a radiant heater with control of temperature and measurement with thermocouple and potentiometer. At 210° F. all surfaces softened, one was tinged brown and another smoked. Table 2 gives results on both treated and untreated surfaces of linoleum on 72 hours' exposure at 160° F.

From Tables 1 and 2 it is apparent that if scorching and discoloration of linoleum are to be avoided, floor temperatures should not exceed 160° F., or 90° F. above a room temperature of 70° F.

With the increasing tendency to use flush-to-the-wall appliances it became difficult to test them for fire hazard with thermometers projecting ⅛ in. through the board. Breakage of thermometers was also expensive, and the time for making thermometer readings seemed unnecessarily long.

After considerable research at the American Gas Association Testing Laboratories the fire hazard test board was equipped with thermocouples as

Fig. 9. Determining joist and grille temperatures on floor furnaces.

shown in Figs. 7 and 8. These thermocouples are made of No. 24 American Wire Gage iron-constantan, junctions of which are copper plates 5/16 in. square and 0.022 in. thick to which the thermocouple wire ends are silver-soldered 1/8 in. apart. They are placed on white pine wall boards simulating a corner of a room at 3-in. square intervals, starting 6 in. above the floor and extending up to a height of 42 in. Above that height they are spaced at 6-in.

Table 2. Effects Produced on Various Types of Treated and Untreated Linoleum by Exposure to a Constant Temperature of 160° F. for 72 Hours (Average Room Temperature, 70° F.)

Linoleum Type No.	Type of Surface				
	Inexpensive Wax	Varnish	Natural Surface	Lacquer	Expensive Wax
1	Retains original colors	Very light brown	Tinged	Very light brown	Retains original colors
2	Same as type 1	Same as type 1	Same as type 1	Same as type 1	Same as type 1
3	Same as type 1	Same as type 1	Surface lost some of original luster	Same as type 1	Same as type 1
4	Same as type 1	Same as type 1	Tinged	Same as type 1	Same as type 1

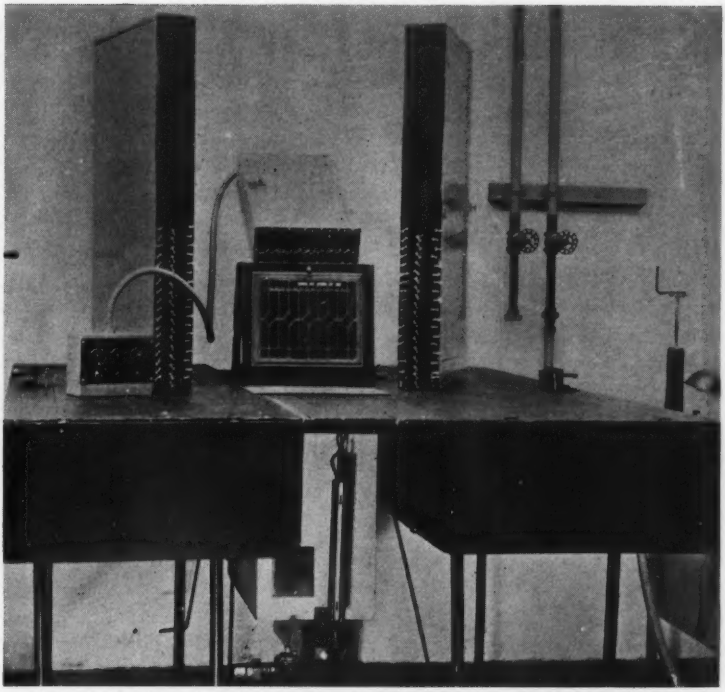


Fig. 10. Test equipment for measuring temperature on a dual register head of a floor furnace where it would contact wall surfaces. Note thermocouples projecting through three wall boards.

square intervals. Surfaces of the copper plates and the wall are painted dull black. Thermocouples are located at 6-in. square intervals on the floor, as shown in Fig. 8. It was found that with use of floor thermocouples practically identical results are obtained as with thermometers in corresponding positions. Since only a small portion of mercury-bulb thermometers are exposed in making wall temperature readings and no stem correction is applied, wall temperatures indicated by thermocouples are higher than those registered by thermometers; consequently, when thermocouples are employed in place of wall thermometers, a temperature limit of 120° is allowed in place of 90°, as mentioned above. This new limit also corresponds to the allowable wall temperatures permitted by Underwriters' Laboratories in their Standard for Domestic Electric Ranges issued in December, 1940. Test data further indicate that 120° F. rise in temperature on a wall, as measured by means of a thermocouple, is practically equivalent to a 90° F. rise (±10% tolerance) when using a thermometer. Requirements for gas ranges soon to become effective incor-

porate this change to use thermocouples and apply a limitation of 120° F. on walls. A 90° F. rise on the floor is retained for reasons previously mentioned.

Because of the differences in construction of domestic gas ranges, depending on their location with respect to walls, they have been classified into 4 types, depending on their compliance with fire hazard tests at various distances from the walls. This may best be illustrated by the following Table 3, reproducing the heading and tabulation appearing in the American Gas Association Directory of Approved Gas Appliances and Listed Accessories for January 1, 1942. This further means of identification of approved ranges and of aiding in their proper installation was included in our Directory at the suggestion of an actuarial agency of fire underwriters.

Appliances which are designed for location in the floor or walls, as for example floor furnaces and wall heaters, are limited to 90° F. rise on those surfaces of the appliance which would come in contact with the wall and floor. Special test equipment is needed for these tests and two of these typical arrangements of apparatus for their conduct are shown in Figs. 9 and 10. Note in Fig. 9 the thermocouples under the floor grille and thermometers projecting

Table 3.

Domestic gas ranges listed herein are classified under the following types:

Type A—Uninsulated
Type B—Insulated
Type C—Flush-to-Wall
Type D—Miscellaneous

Installation should be made as shown by the following table for the particular types indicated. All approved ranges are tested under American Standard Approval Requirements for Domestic Gas Ranges to insure that temperatures of adjacent combustible walls and surfaces will not be excessive when the range is set on its own base or legs and installed as specified.

Type of Range	Spacing of Top Burner Opening from Side of Range	Distance from Combustible Walls, Inches			
		Sides		Rear	
		Wall Not Extending Above Cooking Top	Wall Extending Above Cooking Top	Body of Range	Projecting Flue Box
Type A Uninsulated	...	6	6	6	1
Type B Insulated	Less than 5 in.	½	3	1	1
	5 in. or more	½	½	1	...
Type C Flush-to-Wall	Less than 5 in.	Flush	3	Flush	...
	5 in. or more	Flush	Flush	Flush	...

Type D ranges include combination gas ranges which may also be operated with solid or liquid fuel, bungalow type gas ranges with solid or liquid fuel-burning sections, and gas ranges with approved gas space heater sections.

For further details, reference should be made to A.G.A. Requirements and Recommended Practice for House Piping and Appliance Installation, 1940.

through the floor joist underneath the floor making direct contact with the sides of the floor furnace. Fig. 10 shows the arrangement of thermocouples for determining temperature of a dual register head of a floor furnace at points where it would come in contact with a wall.

With the increasing use of electrical auxiliaries on modern gas equipment a great deal of consideration has been given to insuring safe installations. Adequate provisions are already incorporated in the applicable requirements necessitating that such devices and their wiring comply with provisions of the National Electrical Code and installed in an approved manner.

While it has been impossible to discuss every requirement covered by the various American Standards to assure safety of gas appliances from the fire hazard standpoint, it will be apparent that all possible details are covered by construction and performance tests applied at the American Gas Association Testing Laboratories. Tangible results of this intensive program have been evidenced by increasing satisfactory use of gas equipment and the decreasing losses by fire as evidenced by data presented earlier in this paper.

Forest Park Sanitarium Fire.

Fire swept through the Forest Park Sanitarium on Sunday, January 31, 1943, and claimed the lives of thirty-two of the forty-nine aged patients. The sanitarium was a two-story frame building, privately owned and operated, located approximately eight miles from the city of Seattle, Washington. It was one of about fifty such institutions located in the vicinity of Seattle, a remodeled dwelling, sadly lacking in both public and private protection again fire.

Story of the Fire.

On the day when the tragedy occurred, a repairman was connecting a circulating heater in the basement of the sanitarium to an outside tank. At approximately 1:45 P.M. the man lit a match and the head flew off, landing in a quantity of oil spilled on the floor near the heater. The repairman, although badly burned, ran upstairs for water and attempted to extinguish the blaze. However, the water on the burning oil caused it to scatter and flare, and in a matter of seconds the entire room was in flames. Although the repairman rushed upstairs again and gave the alarm as soon as he saw that the fire was beyond control, many of the aged and feeble patients were trapped and burned in their beds by the swift spread of the blaze through the old frame building.

Even if the inmates of the institution had been in the best of health it is unlikely that they would have escaped with their lives. There were only three exits from the building, and one of these was blocked by the body of a fatally burned man. It is reported that this door opened inward. A volunteer fire chief, arriving from only a mile and a half away, found the entire structure in

International.

Thirty-two aged patients were trapped and burned to death in the blazing sanitarium, which was of highly combustible construction and lacked any effective fire protection.

flames. The blaze was fought by several volunteer fire departments, but had spread so rapidly that outside help proved of little value. Crowds of curious spectators hindered the rescue work of policemen, firemen and doctors from a near-by naval hospital.

Failure to provide automatic sprinkler protection, inadequate exits and flimsy building construction were the major contributing factors to the quick spread of the fire and the resulting heavy loss of life.

Fire Record of Cities, 1942.

The following tabulation prepared by the N.F.P.A. Department of Fire Record gives 1942 fire record data for cities in the United States and Canada which have populations of over 25,000. Blanks in the tabulation indicate that the cities do not report these figures or have not responded to requests for their reports. The questionnaire sent to the various cities asked that the fire loss data reported include both insured and uninsured losses, and that both chimney and roof fires be included in the number of building fires. However, reports of the cities are not all compiled on a uniform basis. Differences in methods of determining fire losses, and in differentiating between alarms and building fires, should be considered in any use of these figures for comparison between cities.

In addition to the 1942 fire records of individual cities, this survey provides a good indication of the fire experience of the United States and Canadian cities as a group. A total of four hundred U. S. cities having more than 25,000 population, according to the 1940 U. S. Census, reported a fire loss for the year 1942 of $93,004,181, amounting to an average loss per person of $1.81 for the 51,333,927 inhabitants of this group of cities. This may be compared with a fire loss of $124,790,152, or $2.23 per capita for a similar group of cities of over 25,000 population reporting 1941 losses.

Thirty-four Canadian cities having a total population of 4,283,261 reported a total loss of $9,188,696 for 1942, as compared with $9,136,259 for 1941. Thus the per person loss was $2.14 in 1942, as compared with $2.13 in 1941.

A total of 390 U. S. cities reported both loss data and the number of building fires. The average loss per building fire in these cities for 1942 was $445, as compared with $576 in 1941. The average loss per building fire for 34 Canadian cities was $495, as compared with $497 in 1941.

The total number of building fires reported by 396 U. S. cities was 206,044, an average of 4.02 per 1000 population, as compared with 3.61 building fires per 1000 population in 1941. It is interesting to note that the average number of building fires in the United States cities rose 11.3 per cent in 1942 above the previous year, whereas, the average loss per person in the same group of cities fell almost 19 per cent. However, a comparison with the 1941 fire record (published in the April, 1942, QUARTERLY), shows that almost three-quarters of the improvement in the 1942 fire record in this group of cities may be accounted for in the experience of eight cities which had suffered unusually large fires or conflagrations in 1941. For example, the Fall River rubber conflagration loss of October, 1941, was reported at $14,000,000 last year, and

thus was responsible for more than 10 per cent of the loss in the entire group of cities in 1941.

Thirty-four Canadian cities reported 18,570 building fires in 1942, as compared with 18,322 in 1941. The number of building fires per 1000 population was 4.33 in 1942, as compared with 4.29 in 1941.

Fire departments in 404 U. S. cities of more than 25,000 population answered 520,553 alarms in 1942. In most instances the figure given for alarms included all calls answered by the fire department, including various types of emergency calls in addition to fire calls. One fire department even listed the parades attended. The number of alarms answered by the fire departments of the 34 Canadian cities was 34,807.

1942 Fire Losses, Cities of 25,000 Population or Over.

City	1940 Population	Total Loss 1942	No. Alarms 1942	No. Bldg. Fires 1942	Bldg. Fires per 1000 Population	5-Year Av. Loss per Person
Alabama						
Anniston	25,523	....	....	....	....	....
Birmingham	267,583	$560,481	3,337	1,290	4.8	$1.53
Gadsden	36,975	14,948	460	350	9.5	0.49
Mobile	78,720	129,821	1,523	1,150	14.6	1.09 (4)
Montgomery	78,084	83,069	484	331	4.2	1.33
Tuscaloosa	27,493	93,988	203	92	3.4	1.59
Arizona						
Phœnix	65,414	61,146	663	351	5.4	0.83
Tucson	36,818	78,716	366	114	3.1	2.38
Arkansas						
Fort Smith	36,584	267,294	720	190	5.2	4.32
Little Rock	88,039	527,491	1,857	581	6.6	2.87
California						
Alameda	36,256	16,603	502	147	4.1	0.55
Alhambra	38,935	14,700	266	29	0.7	0.34 (2)
Bakersfield	29,252	158,464	329	82	2.8	3.49
Berkeley	85,547	72,467	1,060	325	3.8	0.93
Beverly Hills	26,823	48,361	159	63	2.4	1.67
Burbank	34,337	95,967	489	37	1.1	1.19
Fresno	60,685	63,232	380	138	2.3	1.61
Glendale	82,582	24,680	649	139	1.7	0.26
Huntington Park	28,648	32,255	140	60	2.1	1.91
Inglewood	30,114	7,484	191	55	1.8	0.69
Long Beach	164,271	126,799	1,397	413	2.5	0.65
Los Angeles	1,504,277	2,207,113	15,368	4,455	3.0	....
Oakland	302,163	587,013	3,276	1,239	4.1	1.31
Pasadena	81,864	83,670	487	167	2.0	0.88
Riverside	34,696	16,682	338	111	3.2	2.34
Sacramento	105,958	342,019	1,211	458	4.3	2.13 (4)
San Bernardino	43,646	40,000a	545	128	2.9	2.28

a. Estimated. (2) Two-year average. (4) Four-year average.

City	1940 Population	Total Loss 1942	No. Alarms 1942	No. Bldg. Fires 1942	Bldg. Fires per 1000 Population	5-Year Av. Loss per Person
California (Cont'd)						
San Diego	203,341	458,249	3,092	....	....	0.85
San Francisco	634,536	....b	9,106	3,258	5.1	....
San Jose	68,457	70,054	683	301	4.4	0.89
Santa Ana	31,921	12,276	278	90	2.8	0.39
Santa Barbara	34,958	26,150	343	98	2.8	0.95
Santa Monica	53,500	16,084	352	167	3.1	0.52
South Gate	26,945	73,445	298	58	2.2	0.93
Stockton	54,714	116,990	967	226	4.1	1.86
Colorado						
Colorado Springs	36,789	23,606	528	282	7.7	0.95
Denver	322,412	646,340	4,001	1,407	4.4	1.27
Pueblo	52,162	35,492	764	284	5.4	0.50
Connecticut						
Bridgeport	147,121	559,030	1,291	531	3.6	2.45
Bristol	30,167	31,091	330	83	2.8	2.12
Greenwich	35,509	97,808	566	103	3.0	4.01 (4)
Hartford	166,267	201,621	1,673	679	4.1	1.21
Meriden	39,494	55,449	378	172	4.4	2.20
Middletown	26,495	8,397	251	110	4.2	3.49
New Britain	68,685	393,478	626	166	2.4	3.55
New Haven	160,605	260,533	2,321	697	4.4	1.85
New London	30,456	50,371	428	143	4.7	6.59
Norwalk	39,849	66,843	651	218	5.5	1.09
Stamford	47,938	141,494	684	253	5.3	2.58
Torrington	26,988	8,833c	209	38	1.4	1.14
Waterbury	99,314	406,099d	1,504	457	4.6	2.15
West Hartford	33,776	76,038a	372	133	3.9	144.
West Haven	30,021	....	....	....	....	....
Delaware						
Wilmington	111,432	174,954	968	586	5.3	1.26
District of Columbia						
Washington	663,091	1,014,585	8,647	2,869	4.3	1.00
Florida						
Jacksonville	173,065	279,851	2,293	1,653	9.6	2.07
Miami	172,172	93,426e	2,352e	384e	2.2	0.77
Miami Beach	28,012	11,909	252	108	3.8	0.35 (3)
Orlando	36,736	29,074	444	53	1.5	0.59
Pensacola	37,449	....	450	405	1.1	....
St. Petersburg	60,812	149,397	165	134	2.2	1.10
Tampa	108,391	188,281	1,236	794	7.3	1.23
West Palm Beach	33,693	13,325	243	90	2.7	0.64 (4)

a. Estimated. b. Does not report losses. c. Insurance loss only. d. Fiscal year ending Aug. 31. e. Fiscal year ending June 30. (3) Three-year average. (4) Four-year average.

City	1940 Population	Total Loss 1942	No. Alarms 1942	No. Bldg. Fires 1942	Bldg. Fires per 1000 Population	5-Year Av. Loss per Person
Georgia						
Atlanta	302,288	290,872	4,191	814	2.7	1.28
Augusta	65,919	69,823	964	500	7.6	1.46 (4)
Columbus	53,280	....	....	....	....	....
Macon	57,865	85,229	653	358	6.2	1.52
Rome	26,282	57,044	427	202	7.5	1.52
Savannah	95,996	88,740	1,115	507	5.3	1.13
Idaho						
Boise	26,130	97,463	290	168	6.4	3.84
Illinois						
Alton	31,255	24,057	311	149	4.8	2.78
Aurora	47,170	89,306	512	230	4.9	1.27
Belleville	28,405	17,808	363	116	4.1	0.53
Berwyn	48,451	22,540	274	48	1.0	0.32
Bloomington	32,868	17,356	367	154	4.7	3.97
Chicago	3,396,808	4,800,000	24,153	8,866	2.6	1.42
Cicero	64,712	139,215	533	200	3.1	0.90
Danville	36,919	323,169	451	159	4.3	2.72 (4)
Decatur	59,305	144,081	675	390	6.6	1.56
East St. Louis	75,609	88,189	1,223	489	6.5	0.94 (4)
Elgin	38,333	28,230	255	119	3.0	0.67
Evanston	65,389	60,007	568	272	4.2	2.99
Galesburg	28,876	67,215	296	121	4.2	1.16
Joliet	42,365	58,044	487	183	4.3	2.53
Maywood	26,648	10,409	183	150	5.6	0.58
Moline	34,608	28,998	341	50	1.4	0.71
Oak Park	66,015	19,569	408	219	3.3	0.32
Peoria	105,087	134,691	1,132	809	7.7	1.82
Quincy	40,469	23,848	435	267	6.6	1.22
Rockford	84,637	158,693	1,182	441	5.2	0.92
Rock Island	42,775	59,213	452	178	4.2	1.24
Springfield	75,503	325,316	851	372	4.9	2.35
Waukegan	34,241	10,541	450	195	5.7	1.09
Indiana						
Anderson	41,572	31,895	701	336	8.1	0.85
East Chicago	54,637	455,249	1,416	545	10.0	3.13
Elkhart	33,434	67,356	405	230	6.9	1.22
Evansville	97,062	84,019	1,467	847	8.7	2.02
Fort Wayne	118,410	37,545	1,469	743	6.3	0.66
Gary	111,719	51,355	1,381	458	4.1	0.75
Hammond	70,184	83,588	756	271	3.9	0.79
Indianapolis	386,972	1,077,962	3,559	2,084	5.4	1.69
Kokomo	33,795	43,638f	410	238	7.1	0.74
Lafayette	28,798	39,575	333	120	4.2	1.88
Marion	26,767	36,105	377	330	12.3	1.40

f. Does not include one large loss. (4) Four-year average.

City	1940 Population	Total Loss 1942	No. Alarms 1942	No. Bldg. Fires 1942	Bldg. Fires per 1000 Population	5-Year Av. Loss per Person
Indiana (Cont'd)						
Michigan City	26,476	36,645	414	204	7.7	1.27
Mishawaka	28,298	39,825	289	131	4.6	0.76
Muncie	49,720	45,922	784	393	7.9	1.13
New Albany	25,414	36,711	416	244	9.6	3.38
Richmond	35,147	289,916	423	285	8.1	2.13
South Bend	101,268	326,786	1,224	561	5.5	1.77
Terre Haute	62,693	73,373	913	367	5.9	1.87
Iowa						
Burlington	25,832	51,169	487	95	3.8	1.75
Cedar Rapids	62,120	105,964	579	338	5.5	1.25
Clinton	26,270	26,748	368	220	8.4	0.89
Council Bluffs	41,439	30,652	494	239	5.8	1.62
Davenport	66,039	59,216	612	112	1.7	1.49
Des Moines	159,819	211,715	2,292	802	5.0	2.19
Dubuque	43,892	393,757	665	331	7.7	2.71
Mason City	27,080	25,995	257	113	4.2	1.80
Ottumwa	31,570	92,416	419	394	12.5	3.50
Sioux City	82,364	70,194	968	242	2.9	1.19
Waterloo	51,743	127,423	577	272	5.3	2.07
Kansas						
Hutchinson	30,013	53,000	366	186	6.2	....
Kansas City	121,458	154,670	1,550	603	5.0	2.15
Topeka	67,833	37,246	835	448	6.6	1.19
Wichita	114,966	151,299	1,635	724	6.3	1.25
Kentucky						
Ashland	29,537	18,962	264	130	4.3	1.17 (4)
Covington	62,018	27,842	524	420	6.8	0.30
Lexington	49,304	159,324	540	422	8.6	2.14
Louisville	319,077	392,040a	3,151	1,441	4.5	1.28
Newport	30,631	30,538	274	150	4.9	1.12
Owensboro	30,245	21,515a	484	223	7.4	2.17
Paducah	33,765	63,857	825	343	10.2	2.50
Louisiana						
Alexandria	27,066	18,780	335	73	2.7	1.39
Baton Rouge	34,719	20,346	515	41	1.2	0.83
Monroe	28,309	46,460	782	173	6.1	2.52 (3)
New Orleans	494,537	388,847	2,485	1,098	2.2	1.19
Shreveport	98,167	314,635	1,161	372	3.8	2.19
Maine						
Bangor	29,822	97,521	675	543	18.3	2.15
Lewiston	38,598	63,760	819	425	11.3	2.99
Portland	73,643	109,532	1,533	347	4.7	2.25

a. Estimated. (3) Three-year average. (4) Four-year average.

City	1940 Population	Total Loss 1942	No. Alarms 1942	No. Bldg. Fires 1942	Bldg. Fires per 1000 Population	5-Year Av. Loss per Person
Maryland						
Baltimore	859,100	2,125,960	10,101	5,135	6.0	2.25
Cumberland	39,483	55,505	367	265	6.7	1.89
Hagerstown	32,491	....	....	....	....	....
Massachusetts						
Arlington	40,013	33,609a	547	....	....	0.92
Belmont	26,867	15,953	423	147	5.5	1.23
Beverly	25,537	43,747	841	212	8.3	2.36
Boston	770,816	3,871,893	10,424	4,211	5.5	4.08
Brockton	62,343	47,025a	1,590	536	8.6	2.87
Brookline	49,786	149,825	740	505	10.8	1.93
Cambridge	110,879	238,013	1,817	849	7.6	2.28
Chelsea	41,259	137,858	885	199	4.8	4.56
Chicopee	41,664	130,594a	615	174	4.2	1.68
Everett	46,784	89,921	1,059	153	3.3	2.28
Fall River	115,428	89,240	1,144	412	3.6	21.39g
Fitchburg	41,824	72,729	563	339	8.1	3.06
Haverhill	46,752	278,476	1,142	386	8.3	4.83
Holyoke	53,750	280,105	771	393	7.3	3.11
Lawrence	84,323	110,000	1,046	276	3.3	2.98
Lowell	101,389	205,747	1,163	419	4.1	2.11
Lynn	98,123	222,191	1,664	626	6.4	3.79
Malden	58,010	257,246	996	238	4.1	2.35
Medford	63,083	115,113	940	165	2.6	1.49
Melrose	25,333	62,869	307	66	2.6	1.97
New Bedford	110,341	173,858	959	475	4.3	2.87
Newton	69,873	76,678	1,156	240	3.4	1.32
Pittsfield	49,684	207,530	460	205	4.1	2.64
Quincy	75,810	148,592	1,482	370	4.9	2.73
Revere	34,405	47,442	722	90	2.7	2.56
Salem	41,213	191,968	748	193	4.7	3.07
Somerville	102,177	168,740	1,990	436	4.3	2.05
Springfield	149,554	312,342	2,008	556	3.7	1.72
Taunton	37,395	195,042	721	276	7.4	2.30
Waltham	40,020	65,101	605	147	3.7	2.32
Watertown	35,427	49,968	467	57	1.6	1.21
Worcester	193,694	456,394	3,132	749	3.9	2.68
Michigan						
Ann Arbor	29,815	133,116	349	95	3.2	2.21
Battle Creek	43,453	30,110	334	167	3.9	0.80
Bay City	47,956	35,260	791	143	3.0	1.49
Dearborn	63,584	219,206	446	192	3.0	1.55
Detroit	1,623,452	3,261,807a	13,195	6,220	3.8	1.61
Flint	151,543	100,003	1,295	690	4.6	0.91
Grand Rapids	164,292	299,889a	1,134	348	2.1	1.86

a. Estimated. g. Includes $11,000,000 for rubber conflagration in 1941.

City	1940 Population	Total Loss 1942	No. Alarms 1942	No. Bldg. Fires 1942	Bldg. Fires per 1000 Population	5-Year Av. Loss per Person
Michigan (Cont'd)						
Hamtramck	49,839	87,204	348	233	4.7	1.98
Highland Park	50,810	38,548	479	195	3.8	0.93
Jackson	49,656	219,398	642	305	6.1	2.52
Kalamazoo	54,097	189,863	585	318	5.9	2.68
Lansing	78,753	110,566	1,019	170	2.2	1.08
Muskegon	47,697	183,231	443	75	1.6	2.34
Pontiac	66,626	582,147	605	359	5.4	2.75
Port Huron	32,759	154,117	458	220	6.7	2.83
Royal Oak	25,087	....	....	....	....	....
Saginaw	82,794	80,846	818	333	4.1	1.34
Wyandotte	30,618	24,633	305	265	8.7	0.73
Minnesota						
Duluth	101,065	147,969	1,179	709	7.0	1.88
Minneapolis	492,370	702,885	3,617	1,139	2.3	1.93
Rochester	26,312	17,000a	243	133	5.1	1.58
St. Paul	287,736	474,000a	3,249	1,004	3.5	1.90
Mississippi						
Jackson	62,107	26,432	660	268	4.3	1.07
Meridian	35,481	39,930	586	235	6.6	1.89
Missouri						
Joplin	37,144	30,540	787	357	9.6	1.02
Kansas City	399,178	930,303	4,976	....	....	2.05
St. Joseph	75,711	75,094	1,099	698	9.2	1.93
St. Louis	816,048	506,392h	5,616h	2,448h	3.0h	....
Springfield	61,238	73,341	1,040	486	7.9	0.93
University City	33,023	14,016	472	128	3.9	1.29
Montana						
Butte	37,081	39,840	358	78	2.1	1.09
Great Falls	29,928	43,181	324	28	0.9	1.09
Nebraska						
Lincoln	81,984	64,338	846	305	3.8	0.92
Omaha	223,844	420,000	2,638	1,109	5.0	1.54
New Hampshire						
Concord	27,171	29,230	598	368	13.6	1.57
Manchester	77,685	250,000a	766	268	3.5	1.84
Nashua	32,927	200,873	546	334	10.1	3.40
New Jersey						
Atlantic City	64,094	86,190	579	335	5.2	1.40
Bayonne	79,198	98,407	897	375	4.7	1.04
Belleville	28,167	67,765	334	43	1.5	0.82
Bloomfield	41,623	29,564	500	131	3.1	0.59

a. Estimated. h. Last 9 months of 1942 only.

City	1940 Population	Total Loss 1942	No. Alarms 1942	No. Bldg. Fires 1942	Bldg. Fires per 1000 Population	5-Year Av. Loss per Person
New Jersey (Cont'd)						
Camden	117,536	209,700	1,234	383	3.3	2.52
Clifton	48,827	46,375	630	68	1.4	2.55
East Orange	68,945	94,153	543	241	3.5	0.68
Elizabeth	109,912	145,143	814	347	3.2	0.86
Garfield	28,044	6,145	73	47	1.7	0.56
Hackensack	26,279	20,000a	406	105	4.0	1.92
Hoboken	50,115	176,274	435	159	3.2	2.75
Irvington	55,328	67,320	412	181	3.3	0.85
Jersey City	301,173	159,620	2,369	1,270	4.2	2.12
Kearny	39,467	209,267	369	107	2.7	3.94
Montclair	39,807	43,483	436	173	4.3	1.27
Newark	429,760	849,660	3,973	1,747	4.1	1.82
New Brunswick	33,180	59,940	433	154	4.6	1.30
North Bergen Twp.	39,714	....	....	....	....	....
Orange	35,717	10,867	237	76	2.1	0.68
Passaic	61,394	127,282	569	263	4.3	2.98
Paterson	139,656	183,667	1,086	608	4.4	2.48
Perth Amboy	41,242	105,895	138	72	1.7	5.43 (3)
Plainfield	37,469	40,996	592	179	4.8	1.50
Teaneck Twp.	25,275	18,605	647	101	4.0	1.03 (3)
Trenton	124,697	131,455	1,024	458	3.7	1.52
Union City	56,173	82,076	773	219	3.9	1.08
West New York	39,439	37,398	363	223	5.7	0.97
West Orange	25,662	8,800	369	95	3.7	0.67 (4)
Woodbridge	27,191	....	216	28	1.0	....
New Mexico						
Albuquerque	35,449	95,785	326	160	4.5	1.59
New York						
Albany	130,577	122,512	1,643	773	6.0	1.92
Amsterdam	33,329	75,466	247	172	5.2	3.85
Auburn	35,753	15,762	231	102	2.9	0.61
Binghamton	78,309	140,106	556	207	2.6	2.29
Buffalo	575,901	688,360	3,875	1,243	2.5	1.62
Elmira	45,106	58,141a	361	201	3.5	1.22
Jamestown	42,638	138,257a	430	206	4.8	2.42
Kingston	28,589	27,116	376	....	....	1.38
Mount Vernon	67,362	74,832	468	163	2.4	1.41
Newburgh	31,883	23,261	214	84	2.6	1.55
New Rochelle	58,408	98,072	460	197	3.4	0.94
New York City	7,454,995	9,346,835	39,361	16,943	2.3	1.22
Niagara Falls	78,029	127,847	674	275	3.5	1.27
Poughkeepsie	40,478	55,461	458	190	4.7	1.08
Rochester	324,975	352,962	2,357	774	2.4	1.13
Rome	34,214	243,583	273	178	5.2	3.46

a. Estimated. (3) Three-year average. (4) Four-year average.

City	1940 Population	Total Loss 1942	No. Alarms 1942	No. Bldg. Fires 1942	Bldg. Fires per 1000 Population	5-Year Av. Loss per Person
New York (Cont'd)						
Schenectady	87,549	128,403	875	261	3.0	1.23
Syracuse	205,967	555,640	1,441	559	2.7	1.41
Troy	70,304	239,924	834	486	6.9	1.71
Utica	100,518	282,135	503	208	2.1	1.45
Watertown	33,385	109,404	300	177	5.3	2.51
White Plains	40,327	25,552	466	96	2.4	0.90
Yonkers	142,598	141,639	1,479	615	4.3	1.46
North Carolina						
Asheville	51,310	24,814	660	51	1.0	1.05
Charlotte	100,899	136,843	1,540	737	7.3	1.57
Durham	60,195	34,677	611	275	4.6	0.74
Greensboro	59,319	54,333	808	163	5.8	1.04
High Point	38,495	258,612	452	171	4.4	2.28
Raleigh	46,897	46,041	638	340	7.3	0.82
Rocky Mount	25,568	13,365	219	112	4.4	0.50
Wilmington	33,407	61,943	581	369	11.0	1.76
Winston-Salem	79,815	70,852	876	176	2.2	0.92
North Dakota						
Fargo	32,580	30,351	194	176	5.4	2.19
Ohio						
Akron	244,791	379,315	2,336	861	3.5	1.17
Canton	108,401	79,108	823	273	2.5	1.18
Cincinnati	455,610	1,353,650	4,490	1,707	3.8	1.67
Cleveland	878,336	2,532,940	8,336	2,575	2.9	2.30
Cleveland Heights	54,992	12,212	585	153	2.8	0.51
Columbus	306,087	174,409	6,285	2,834	9.2	0.82
Dayton	210,718	325,351	2,344	1,249	5.9	1.52
East Cleveland	39,495	11,761	269	89	2.3	0.50
Elyria	25,120	27,775	175	79	3.1	2.13
Hamilton	50,592	107,018	621	537	10.6	1.80
Lakewood	69,160	105,619	239	74	1.1	0.56
Lima	44,711	186,695	440	183	4.1	1.37
Lorain	44,125	105,404	446	101	2.3	1.10
Mansfield	37,154	257,381	235	168	4.5	2.44
Marion	30,817	30,598	334	189	6.1	2.09
Massillon	26,644	10,219	175	84	3.2	1.16
Middletown	31,220	62,800	329	199	6.4	2.25
Newark	31,487	15,329	340	96	3.0	0.51
Norwood	34,010	10,923	193	108	3.2	0.60
Portsmouth	40,466	86,842	426	239	5.9	1.59
Springfield	70,662	143,503	728	451	6.4	2.07
Steubenville	37,651	132,994	381	150	4.0	2.35
Toledo	282,349	285,907	2,209	1,011	3.6	1.52
Warren	42,837	33,430	403	254	5.9	0.73
Youngstown	167,720	160,625	1,412	629	3.9	1.02
Zanesville	37,500	9,862	344	225	6.0	0.73

City	1940 Population	Total Loss 1942	No. Alarms 1942	No. Bldg. Fires 1942	Bldg. Fires per 1000 Population	5-Year Av. Loss per Person
Oklahoma						
Enid	28,801	13,203	345	97	3.4	0.65
Muskogee	32,332	46,122	900	236	7.3	2.41
Oklahoma City	204,424	311,805	2,747	561	2.7	0.90
Tulsa	142,157	99,139	2,863	612	4.3	1.01
Oregon						
Portland	305,394	1,363,000a	4,411	3,363	11.0	2.45
Salem	30,908	71,424	419	....	....	1.20
Pennsylvania						
Aliquippa	27,023	7,518	178	109	4.0	0.40
Allentown	96,904	22,592	245	218	2.2	0.54
Altoona	80,214	39,269	635	332	4.1	0.48
Bethlehem	58,490	263,105	....	103	1.8	3.12
Chester	59,285	411,000	302	186	3.1	3.65
Easton	33,589	217,720	140	90	2.7	1.82
Erie	116,955	101,288	897	369	3.1	0.82
Harrisburg	83,893	88,798	479	329	3.7	1.12
Hazelton	38,009	127,396	115	70	1.8	1.78
Johnstown	66,668	40,421	622	319	7.9	1.04
Lancaster	61,345	119,520	268	140	2.3	1.17
Lebanon	27,206	43,543	67	41	1.5	1.44 (4)
Lower Merion Twp.	39,566	74,175	470	119	3.0	3.07
McKeesport	55,355	58,041	433	197	3.6	0.82
New Castle	47,638	38,727	408	181	3.8	0.89
Norristown	38,181	27,610	165	88	2.3	1.29
Philadelphia	1,931,334	3,003,544	11,801	5,105	2.6	1.78
Pittsburgh	671,659	1,308,327	5,188	3,448	5.1	1.15
Reading	110,568	72,337	430	305	2.8	0.77
Scranton	140,404	231,830	698	331	2.4	1.45 (4)
Sharon	25,622	20,545	242	18	0.7	0.96
Upper Darby Twp.	....	26,000	358	81	3.1	0.30 (2)
Washington	26,166	14,658	227	150	6.0	0.81
Wilkes-Barre	86,236	44,401	507	294	3.4	1.42
Wilkinsburg	29,853	9,400	190	105	3.5	0.54
Williamsport	44,355	28,350	277	110	2.5	2.68
York	56,712	33,490	190	150	2.6	1.26
Rhode Island						
Central Falls	25,121	40,051	204	82	3.3	1.22
Cranston	47,173	42,057	965	156	3.3	1.00 (4)
East Providence	32,093	49,862	677	102	3.2	1.55
Newport	30,402	75,018	365	150	4.9	2.67
Pawtucket	75,449	407,541	1,066	332	4.4	2.51
Providence	253,214	523,950	3,294	629	2.5	1.71
Woonsocket	49,204	212,872	644	206	4.2	3.20

a. Estimated. (2) Two-year average. (4) Four-year average.

City	1940 Population	Total Loss 1942	No. Alarms 1942	No. Bldg. Fires 1942	Bldg. Fires per 1000 Population	5-Year Av. Loss per Person
South Carolina						
Charleston	71,275	135,174	994	459	6.4	1.14
Columbia	62,396	163,663	927	347	5.6	1.36
Greenville	34,734	113,000	433	356	10.3	4.30
Spartanburg	32,249	84,755	515	270	8.4	2.04
South Dakota						
Sioux Falls	40,832	35,836	412	120	3.9	1.33
Tennessee						
Chattanooga	128,163	272,936	1,936	716	5.6	1.81
Johnson City	25,353	19,040	340	100	3.9	0.79
Knoxville	111,580	112,131	1,381	663	5.9	1.01
Memphis	292,942	487,000	4,226	1,287	4.4	1.71
Nashville	167,402	397,714	3,059	808	4.8	2.26
Texas						
Abilene	26,612	475,000a	817	171	6.4	4.88
Amarillo	51,686	257,623	785	158	3.1	1.78
Austin	87,930	218,862	1,346	346	3.6	1.18
Beaumont	59,061	143,600	931	649	11.0	1.21
Corpus Christi	57,301	50,053	832	220	3.8	1.10
Dallas	294,734	1,547,784	4,661	573	2.0	3.86
El Paso	96,810	50,000a	831	365	3.8	0.60 (4)
Fort Worth	177,662	223,326	4,447	1,088	6.1	1.84
Galveston	60,862	295,442	629	327	5.4	2.35
Houston	384,514	948,723	4,324	1,528	4.0	2.00
Laredo	39,274	2,278	179	75	1.9	0.20
Lubbock	31,853	79,729	362	....	....	1.46
Port Arthur	46,140	22,823	356	115	2.5	0.75
San Angelo	25,802	45,324i	480	183	7.1	1.45
San Antonio	253,854	246,919a	2,175	725	2.9	0.70
Tyler	28,279	142,575	564	94	3.3	4.70
Waco	55,982	215,990	821	288	5.2	2.79
Wichita Falls	45,112	228,595	1,003	248	5.5	2.87 (4)
Utah						
Ogden	43,688	55,000a	718	222	5.1	0.96
Salt Lake City	149,934	828,026	1,910	434	2.9	3.10
Vermont						
Burlington	27,686	....	437	250	9.0	7.17 (2)
Virginia						
Alexandria	33,523	23,785	491	....	....	0.75 (2)
Danville	32,749	136,598	364	179	5.5	3.11
Lynchburg	44,541	67,523	783	291	6.5	1.72
Newport News	37,067	178,018	799	390	10.5	1.55
Norfolk	144,332	608,058	3,198	1,437	10.0	3.10

a. Estimated. i. Includes county fires. (2) Two-year average. (4) Four-year average.

City	1940 Population	Total Loss 1942	No. Alarms 1942	No. Bldg. Fires 1942	Bldg. Fires per 1000 Population	5-Year Av. Loss per Person
Virginia (Cont'd)						
Petersburg	30,631	34,032	402	240	7.8	1.10
Portsmouth	50,745	177,065	974	290	5.7	2.22
Richmond	193,042	196,826	2,995	1,771	9.2	0.83
Roanoke	69,287	119,384	811	410	5.9	1.30
Washington						
Bellingham	29,314	110,913	562	159	5.4	1.63
Everett	30,224	29,480	613	436	14.5	0.82
Seattle	368,302	566,570	4,390	2,980	8.1	1.21
Spokane	122,001	152,777	2,094	683	5.6	2.36
Tacoma	109,408	511,041	2,188	1,527	13.9	2.08
Yakima	27,221	26,165	324	162	6.0	2.83
West Virginia						
Charleston	67,914	67,599	677	221	3.3	1.05
Clarksburg	30,579	55,612	275	224	7.3	1.51
Huntington	78,836	218,772	920	290	3.7	1.57
Parkersburg	30,103	118,389	290	85	2.8	1.14
Wheeling	61,099	64,450	565	446	7.3	1.44
Wisconsin						
Appleton	28,436	74,032	255	153	5.4	1.22
Beloit	25,365	35,783	444	289	11.4	0.74
Eau Claire	30,745	30,523	359	190	6.2	1.35
Fond du Lac	27,209	15,644a	285	197	7.2	2.63
Green Bay	46,235	157,854	464	208	4.5	1.75
Kenosha	48,765	37,946	717	280	5.7	0.77
La Crosse	42,707	46,093	388	144	3.4	0.78
Madison	67,447	75,526	756	402	6.0	1.54
Milwaukee	587,472	584,844	5,215	3,170j	5.4	1.01
Oshkosh	39,089	33,379	323	228	5.8	0.82
Racine	67,195	73,626	475	297	4.4	1.39
Sheboygan	40,638	31,400	288	244	6.0	0.65
Superior	35,136	1,308,163	638	231	6.6	1.04
Wausau	27,268	18,035	519	338	12.4	0.79
Wauwatosa	27,769	15,364	153	75	2.7	0.55
West Allis	36,364	38,090	338	69	1.9	0.79

1942 Fire Losses, Canadian Cities.

Alberta						
Calgary	85,726	$84,515	501	112	1.3	$1.77
Edmonton	91,723	515,822	719	366	4.0	3.24
British Columbia						
Vancouver	360,000	688,445a	2,816	1,612	4.5	1.62
Victoria	49,000	17,927	668	258	5.3	0.79
Manitoba						
Winnipeg	224,252	276,940	2,635	1,748	7.8	1.27

a. Estimated. j. Includes 1244 fires to which fire department was not called.

1942 Fire Losses, Canadian Cities (Cont'd).

City	1940 Population	Total Loss 1942	No. Alarms 1942	No. Bldg. Fires 1942	Bldg. Fires per 1000 Population	5-Year Av. Loss per Person
New Brunswick						
St. John	50,000	119,737	692	246	4.9	7.36
Nova Scotia						
Glace Bay	25,000	46,333	93	66	2.6	3.63
Halifax	90,000	460,817	981	676	7.5	3.05
Sydney	25,000	69,000	344	94	3.8	4.74
Ontario						
Brantford	31,526	14,476	264	114	3.6	1.66
East York Twp.	38,182	5,116	174	53	1.4	0.19 (3)
Fort William	26,251	26,020	439	343	13.1	2.31
Hamilton	155,836	596,369	1,099	690	4.4	2.11
Kirkland Lake	25,000	13,163	337	266	10.6	0.68 (3)
Kitchener	33,000	56,167	143	32	1.0	1.12
London	78,000	66,749	487	262	3.4	0.92
Oshawa	26,370	51,510	212	137	5.2	0.87
Ottawa	159,264	366,162	1,815	975	6.1	2.32
St. Catharines	27,800	206,244	238	157	5.6	2.91
Sault Ste. Marie	25,283	94,842	248	59	2.3	2.76
Sudbury	32,371	69,465	476	392	12.0	1.41 (3)
Timmins	27,000	13,425	406	360	13.3	1.49 (3)
Toronto	649,123	1,579,228	4,540	2,294	3.5	2.11
Windsor	103,567	110,000a	776	350	3.4	1.30
York Twp.	77,000	....	....	....	....	....
Quebec						
Hull	30,909	35,234	775	616	2.0	1.23
Montreal	1,286,388	1,972,723k	7,037	2,472	1.9	1.28
Quebec	150,000	987,035	2,986	2,076	1.4	4.04
Sherbrooke	34,000	109,661	691	551	16.2	2.91
Three Rivers	42,000	38,861	639	354	8.4	1.08
Outremont	31,000	103,726	197	96	3.1	2.33 (3)
Verdun	65,000	172,579	322	209	3.2	1.31 (3)
Westmount	26,000	70,417	275	75	2.9	2.11 (3)
Saskatchewan						
Regina	60,000	24,217	431	256	4.3	0.85
Saskatoon	41,690	124,771	351	203	4.9	1.26

a. Estimated. k. First 10 months only. (3) Three-year average.

Glenn Perrins, Deseret News.

Fire started on the top floor of this department store in Salt Lake City at 6 A.M. on September 28. Because of the lack of proper gas mask equipment ten firemen were overcome.

Large Loss Fires, 1942—Supplement.

The annual tabulation of large loss fires appeared as usual in the January QUARTERLY. That article, prepared by the N.F.P.A. Department of Fire Record, included all fires reported to us up to the date of publication each of which involved a loss of $250,000 or more. There is often a marked difference in the original estimates of losses recorded on initial fire reports and the final losses determined and reported to us months later. These revisions may be upward or downward and if the quarter-million dollar criterion is in the balance, it is obvious that the change must affect our annual tabulation.

We present below summaries of six fires about which loss information was received after the January QUARTERLY had gone to press.

These fires include an army warehouse, a shipyard, a cannery, a department store, a coal breaker, and a mercantile building.

July 26, Richmond, Va. Military Property. Loss: $500,000.

Spontaneous ignition of chemically treated empty sand bags resulted in the destruction of a large quantity of army supplies and severe damage to a warehouse at the Richmond Quartermaster Depot. The building was a single-story fire-resistive warehouse having a total area of some 120,000 square feet subdivided by fire walls. It was not equipped with automatic sprinklers. While complete details of the fire are not available, it is understood that the destruction was confined to two of the fire areas.

September 28, Salt Lake City, Utah. Auerbach Store. Loss: $472,000.

Fire of undetermined origin swept through the upper floors of this four-story fire-resistive department store, resulting in serious fire and water damage to the building and contents. The fire, which started in a third floor storeroom, was discovered during the early morning by the watchman, who telephoned the fire department. The fire was well advanced, and burning upholstery materials produced large volume of acrid smoke which hampered fire fighting operations. The undermanned and inadequately equipped fire department was barely able to control the fire with the aid of auxiliaries. Because of the lack of proper gas mask equipment ten firemen were overcome. The fire was finally flooded out with large quantities of water, which ran down elevator shafts, stairways and conduits to cause severe damage to stocks and fixtures on lower floors.

December 1, Trevorton, Pa. Stevens Coal Co. Loss: $256,000.

This was an anthracite coal breaker of galvanized iron on steel and wood frame construction. The building, 105 feet in height, had several plank platforms of different heights and was open throughout. The fire was discovered at about 4:00 A.M. by workmen who were making repairs to machinery. The fire originated at a switchboard located about midway in height in the structure. They immediately started the electric pump operating and directed a

Providence Journal.

This huge shipyard fabricating building in Providence, R. I., burned on December 31, 1942. The frame of the building was steel, and the contents heavy machinery and steel in process, but the walls were plywood and the roof wooden plank. No automatic sprinklers were provided, and there was no fire wall between the small section at the left, where the fire started, and the main area. Employees fought the fire for 15 minutes before calling the Providence Fire Department. The management claimed that there was no serious delay in production because the work could be continued outdoors.

hose stream on the fire. The men claimed that they could have extinguished the fire in another two minutes, but the switch controlling the pump short-circuited and they were unable to get water. They then called the Trevorton and Shamokin fire departments, and it was about a half hour from the time the fire was discovered until the first pumper arrived. By this time the building was burning fiercely. There was neither public water supply nor hydrants, and the fire department drew water from a creek. Due to the height and construction of the building, it acted as a flue. As the beams and girders became heated they twisted and broke loose, falling to the bottom and destroying the machinery as they fell. "When the fire was over the place looked like a scrap heap."

December 15-16, Boston, Mass. Multiple Mercantile. Loss: $421,321.

A five-alarm fire, cause unknown, practically destroyed the 6-story Amory Building and resulted in smoke and water damage to the 11-story Blake Building adjoining. The Amory Building was occupied by several retail clothing establishments and other mercantiles. The fire started in the basement shortly before midnight and was not extinguished until it had extended through the roof. It spread rapidly through open fire doors and up the elevator shaft, with the result that all floors were involved by the time the firemen arrived. The fire department was considerably hampered by unusually dense smoke which filled the building, and intense burning of escaping gas.

December 28, Markham, Wash. Cranberry Canners, Inc. Loss: $300,000.

Our efforts to obtain information about this fire have been unavailing, but we understand that this cannery was destroyed, together with a 10,000-gallon pack destined for the Army.

December 31, Providence, R. I. Rheem Mfg. Co. Loss: $250,000-$1,000,000.

Fire attributed to careless smoking practically destroyed two of the largest and most important buildings at this shipyard where "Liberty" ships were under construction. The buildings involved were the fabricating shop and the furnace building adjoining. Both were of plywood and tar paper on light steel framework, with plank on wood truss roofs. There were no automatic sprinklers, and first aid fire appliances had been frozen and removed from the buildings for repairs. The fire started in oil-soaked sawdust under a generator in the furnace building and spread through a huge unprotected opening into the fabricating building. The fire was discovered by one of the guards and could have been readily extinguished if adequate first-aid fire equipment had been available. The flames quickly ran up the wooden siding and ignited the roof timbers before the plant fire brigade could get into action. Help was eventually called from Providence and surrounding communities. Dense smoke and intense heat from the burning tar paper and wood, in addition to falling débris, made fire fighting particularly difficult. All woodwork was consumed, and the steel framework of the buildings and valuable machinery and stock within the structures were damaged. It is believed that most of the machinery and other equipment may have been salvaged, as the damage resulted from falling débris. Management claimed little or no interruption to production, but since the fire the Government has put another management in charge of this property.

serious delay in production because the work could be continued outdoors.

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Breather valve atop a flame arrester, a winning combination in conservation and fire prevention for petroleum storage tanks.

● **This past year** there has been an unprecedented boom in the purchase of fire fighting equipment in anticipation of increased needs due to the war. Whether or not the necessity ever arises, our fire FIGHTING equipment is in splendid condition. Fire FIGHTING, however, is definitely not the cure.

● **Fire prevention** equipment represents that "ounce of prevention" we have been taught to respect for many years. Nearly every municipality and industrial establishment is "up" on its "pound of cure." How about the FIRE PREVENTION equipment on petroleum storage tanks and truck tanks? We are specialists in these fields and we will be glad to help you.

S. & J. Internal Safety Valves in the compartments of truck tanks have prevented many disastrous fires during unloading operations and highway accidents.

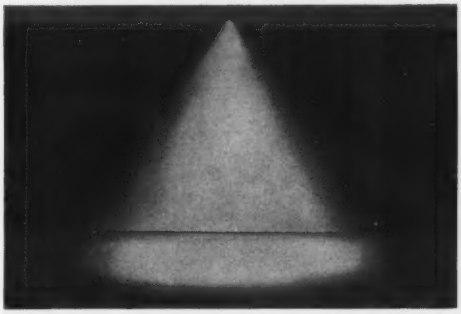
SHAND & JURS COMPANY
BERKELEY, CALIFORNIA
NEW YORK CHICAGO HOUSTON LOS ANGELES SEATTLE

SHAND & JURS

"AUTOMATIC" FIRE-FOG SYSTEM

Color Motion Picture available on request.

Approved by UNDERWRITERS' LABORATORIES, INC.



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CONTROLS FLAMMABLE LIQUID FIRES IN •

AIRPLANE MOTOR TEST CELLS • DIP TANKS • ELECTRIC TRANSFORMERS • LACQUER MIXING AND STORAGE • OIL FILTERS FOR AIR CONDITIONING • SOLVENT PROCESSES SYNTHETIC RUBBER PROCESSES

CONTROLS FIRES IN •

NITRATING PROCESSES • NITROCELLULOSE PROCESSES ROLL POWDER PROCESSES

ENGINEERED TO THE JOB

"AUTOMATIC" SPRINKLER CORPORATION OF AMERICA — RATE OF RISE — TRADE MARK

• Each "Automatic" Fire-Fog installation presents problems requiring individual design and application. "Automatic" maintains a complete service to meet these diverse requirements. Working in accordance with the standards of the insurance bureau or Government agency having jurisdiction, and in co-operation with your own engineering staff, "Automatic's" service includes engineering design, fabrication and installation of the entire system.

HIGH POINTS OF THIS SERVICE INCLUDE:

1. Location of Heat Actuated Devices at proper points for *instant* fire detection and operation of the Suprotex-Deluge Valve.

•

2. Location and direction of fixed Fire-Fog Nozzles for extinguishment of flames at point of origin and wetting down adjacent equipment and materials to prevent spread of fire. In some cases provision is made for auxiliary manually operated Fire-Fog play pipes.

•

3. Examination of the water supply and calculation of friction and static losses between water supply and Fire-Fog Nozzles. Pipes are sized to afford uniform discharge from the Nozzles. Complete hydraulic calculation and water supply report is made for each job.

"AUTOMATIC" SPRINKLER CORP. OF AMERICA

YOUNGSTOWN, OHIO • OFFICES IN PRINCIPAL CITIES

Viking Sprinkler Systems guarding vital War Bases and Plants say "Not Here" to Fire! Today, Viking's entire output is going where the tools of war are made, stored, handled, repaired and used.

Thus in war, as in peace, Viking Sprinkler Systems are proving their dependability. When Viking stands guard, Fire heeds the command "Not Here"! . . . and the tools of war stay fit for their intended job.

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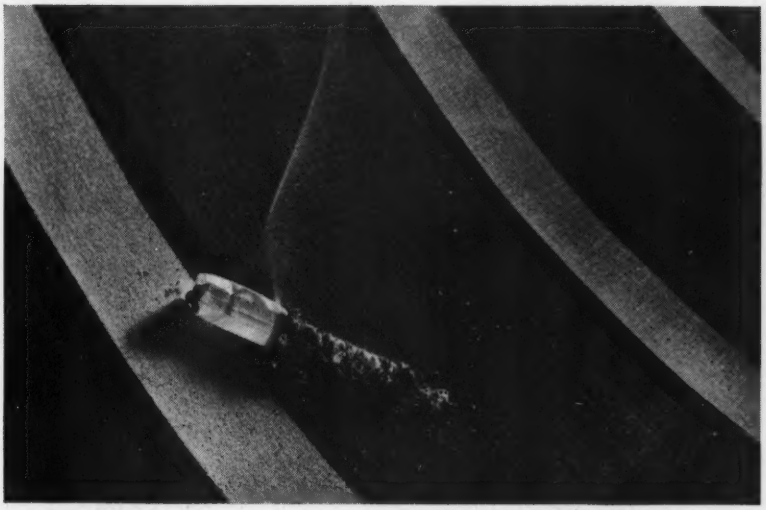


Why Won't This Awning *Burn?*

It's 194X (X meaning after Victory). A carelessly-thrown cigarette falls on an awning. It should start a furious fire. Yet it burns up — goes out.

A hot salamander tips against a canvas windbreak on a big construction job. Disaster in the making. The windbreak merely chars a little. Goes out.

Glowing sparks from a ship's funnel scatter over canvas hatch covers and lifeboat covers. Fire at sea — one of the greatest dreads of humanity. But these sparks gleam for a moment. Go out.

A welding torch wanders for a split second. Strikes a curtain. A nasty fire could result. But the canvas curtain only smokes for an instant. Goes out.

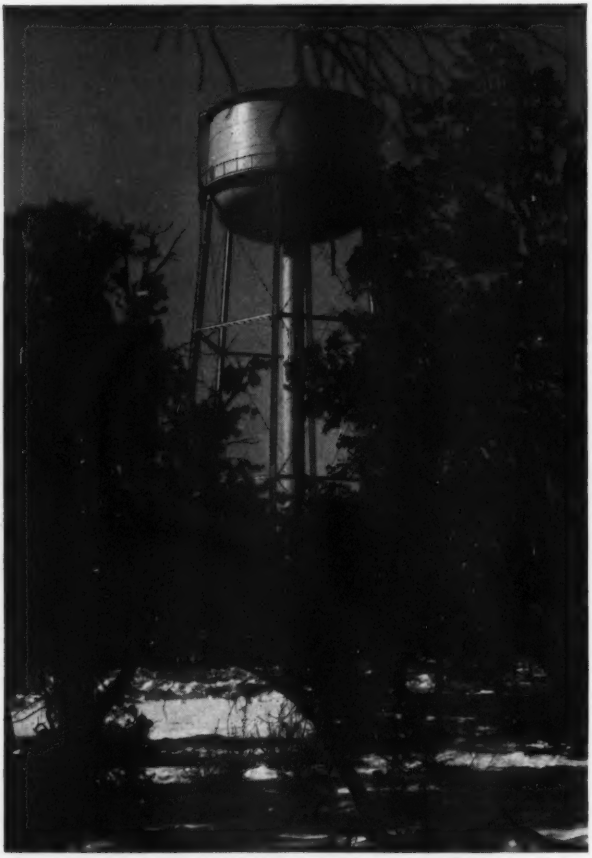
Why won't this Cotton Duck — normally first cousin to guncotton — burn according to its birthright?

Because HOOPERWOOD "Canvas Engineering" has stepped in to make it behave according to man's desires and long-felt needs of public safety.

That and much more already has been accomplished — and is in store for you — when our entire production of HOOPERWOOD "Engineered Canvas" is no longer needed by the Armed Forces. And HOOPERWOOD "Canvas Engineering" goes on, making cotton duck an ever more useful servant of Business and Industry.

WM. E. HOOPER & SONS CO.
New York PHILADELPHIA Chicago
Mills: WOODBERRY, BALTIMORE, MD.

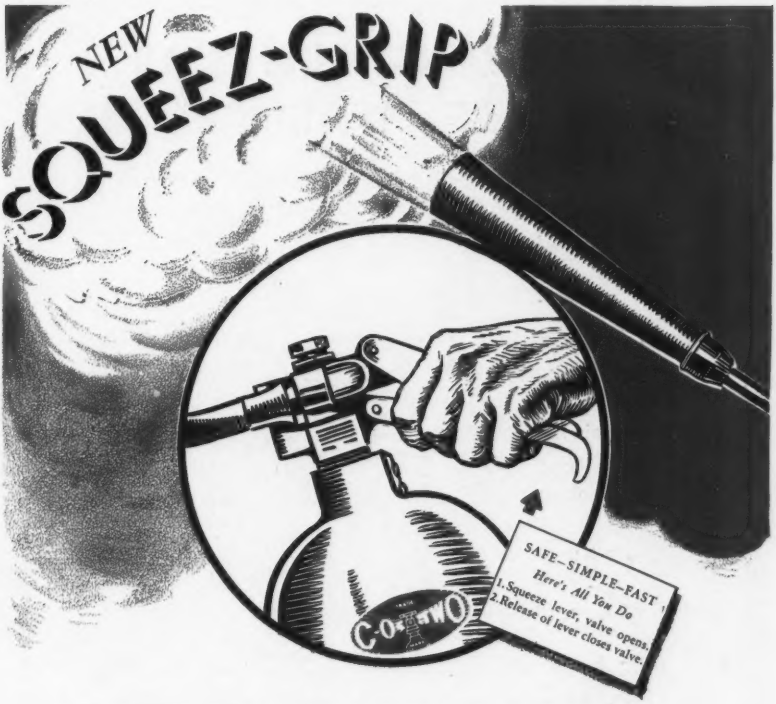
HOOPERWOOD COTTON DUCK



FOR OVER 15 YEARS . . . the 150,000-gal. ellipsoidal-bottom elevated steel tank shown above has been providing water under gravity pressure for fire protection and general service to the Atchison, Topeka & Santa Fe Railway properties at Grand Canyon, Ariz. It is piped for dual service so that only the upper 50,000 gals. of the tank capacity can be drawn off through the domestic service line and the remaining 100,000 gals. are always reserved for fire service.

CHICAGO BRIDGE & IRON COMPANY

CLEVELAND CHICAGO BIRMINGHAM NEW YORK
WASHINGTON HAVANA GREENVILLE, PA. PHILADELPHIA
HOUSTON HILLSIDE, N. J. TULSA SAN FRANCISCO



Heretofore, time and gas were wasted when using a hand-wheel type valve for carbon dioxide extinguishers. Hence, for All-Out action against fire a fast and a gas saving type of release was required; an extinguisher that could be controlled while being carried . . . without the delaying time incident to setting a cylinder down to open or close the hand-wheel; a valve that would release the gas just as quickly as it could be shut off. The new C-O-TWO Squeez-Grip valve combines all these requirements.

SQUEEZ-GRIP IS A SENSATIONAL NEW RELEASE

It represents another of C-O-TWO's contributions to fire protection. With over a decade and a half of carbon dioxide fire extinguishing experience, C-O-TWO originated this all-inclusive Squeez-Grip valve.

Carbon dioxide, the fastest non-damaging fire extinguishing agent, can now be released at the base of a fire as *fast as you can close your hand.* Fire is smothered in seconds, without damage to materials or equipment.

C-O-TWO is listed by the Underwriters' Laboratories; fully approved by Factory Mutuals and the Bureau of Marine Inspection and Navigation.C-O-TWO, is a registered trademark. To be safe, specify C-O-TWO.

C-O-TWO FIRE EQUIPMENT COMPANY

NEWARK NEW JERSEY

Sales and Service in the Principal Cities of United States and Canada

DEFENSE AGAINST FIRE IS AN OFFENSE AGAINST OUR ENEMIES

Star Automatic Sprinklers guarantee the continuity of production and the preservation of essential war materials already completed.

Automatic Sprinklers
Corrosion-Proof Sprinklers
Directional Flow Sprinklers
Open Sprinklers
Ornamental Sprinklers
Alarm Devices

Automatic Releases
Alarm Valve (Wet) Systems
Dry Pipe Valve Systems
Deluge Systems
Heat-Actuating Devices
Pre-Action Systems

Star Automatic Sprinklers and Fire Protection Devices bear approval of all Insurance Authorities having jurisdiction and various Governmental Agencies.

Proven economy in installation cost and maintenance has dictated the consistent policy of Star Sprinkler Corporation in distributing its Fire Protection Devices through local licensed contractors who have had a lifetime of experience in the installation of automatic sprinkler systems. Operating throughout the United States, Canada and South America, Star licensees, due to their strategic locations, can render instant service. Write us for name and address of Star licensed contractor nearest your location.

STAR SPRINKLER CORP.

Westmoreland and Collins Sts. - Philadelphia, Pa.

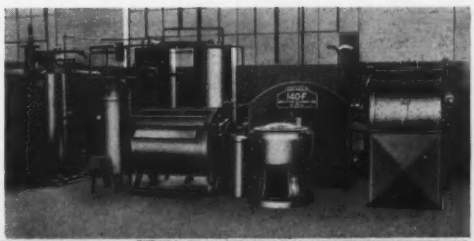
COLD FACTS ABOUT 140·F SAFETY DRY CLEANING

140·F IS A CLASS II UNIT THAT COMPLIES WITH STANDARDS OF N. B. F. U. PAMPHLET NO. 32

What's remarkable about that? Just this! The 140-F is NOT a chlorinated solvent dry cleaning unit. It's the original Safety Petroleum Solvent System — an exclusive development of the U. S. Hoffman Machinery Corporation. It has the operating advantages and economy features that dry cleaners want, yet it is an Approved System that has made a distinct contribution to safety in the dry cleaning industry.

USES 140° FLASH PETROLEUM SOLVENT

The Hoffman 140-F dry cleaning system employs safety petroleum solvent with flash point of approximately 140°F. It has many unusual features, including a drying tumbler from which all vapor is expelled at safe temperatures before tumbler can be opened.



U. S. HOFFMAN MACHINERY CORPORATION
105 Fourth Ave. • New York, N.Y.
EQUIPMENT FOR EVERY DEPARTMENT OF THE DRY CLEANING PLANT

GLOBE

AUTOMATIC SPRINKLERS

WITH WAR-TIME EFFICIENCY
ARE IN SERVICE
ON THE PRODUCTION FRONT

Our complete facilities are now devoted to a definite and important part in the war program.

Relentlessly, day and night, these "Automatic Firemen" are protecting the industries that supply what the military authorities deem absolutely imperative — Ships, Tanks, Planes, Ordnance, Food, and Clothing to

WIN THE WAR!

Globe engineers will gladly discuss your fire protection problems with you. Globe devices embody a maximum of engineering ingenuity with a minimum of critical materials and are approved by all government and underwriting authorities.

GLOBE
Automatic Sprinkler Co.
2035 WASHINGTON AVENUE
Philadelphia, Pa.
SALES OFFICES IN PRINCIPAL CITIES

Fact-O-Crete is *Oilproof!*

FACT-O-CRETE — A Moderate Cost, Light Weight, Seamless, Heavy Duty Floor Laid in Plastic Form

After 17 years of continuous use, this floor is still in excellent condition.

- FIREPROOF
- OILPROOF
- SPARKPROOF
- WEARPROOF
- CRACKPROOF
- WATERTIGHT

Recommended by Fire Underwriters

• Developed in 1927 at the suggestion of the Underwriters, primarily as a fireproof, watertight, light weight flooring for application over wood under industrial spray booth areas, FACT-O-CRETE has proven a flooring material which solves many other industrial problems.

OILPROOF is but one of its unique characteristics. Laid over wood or concrete, it successfully *"prevents oil saturation"* and has proven eminently satisfactory for this purpose in oil storage warehouses, machine shops and similar industrial areas where quantities of oil are present.

O'NEILL FLOORS

FREE Sample: Write for a full size sample of Fact-O-Crete, showing its application to a wood subfloor.

Send for New 8-page Descriptive Catalog.

Warehouses in Wichita, Kans., and New York City.

Address all Correspondence to

E. H. O'NEILL FLOORS COMPANY
105 West Adams St., Chicago, Illinois

Fire-Fighters Appreciate

VALVES
HYDRANTS

AND PIPE LINE ACCESSORIES

M & H products are well known for high quality material and expert workmanship. They have been widely used throughout the country for many years. They include several types of Gate Valves, Check Valves, Flap Valves, Valve Boxes, B & S Fittings, Flanged Fittings, Fire Hydrants and many other cast iron pipe line accessories.

AWWA & UNDERWRITERS APPROVED FIRE HYDRANTS

M & H Fire Hydrants are dry top and revolving head. They are easy to lubricate. Maintenance costs are low due to simplicity of design and rugged construction. They have low friction loss and great efficiency because barrel diameter is not reduced and there are no working parts or obstruction in waterway. Special Traffic model is designed to yield at the ground line under impact. Repair is simple and easy by renewing breakable bolts and breakable coupling on stem.

M&H VALVE
AND FITTINGS COMPANY

ANNISTON, ALABAMA

Did you forget to tell him what to do now?

● It's a fire-fighting axiom that the first 60 seconds of a fire are the most important. If something goes wrong then, you may have a real blaze on your hands.

Alert management, recognizing this, carefully trains its employees to fight fire. It picks key men in the plant, teaches them how different fires behave, how various extinguishers must be handled.

Authorities agree that *demonstrations* provide the best training. So Walter Kidde & Company has prepared a booklet—"How to Teach Fire-Fighting." It tells how to stage a fast-moving, interesting, instructive fire-class. Write for your plant's copy.

Walter Kidde & Company, Inc.
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HIGH PRESSURE GASES • FIRE PROTECTION
PROTECTS LIVES

The NATIONAL FIRE CODES
for
EXTINGUISHING AND ALARM EQUIPMENT
1943

Comprehensive
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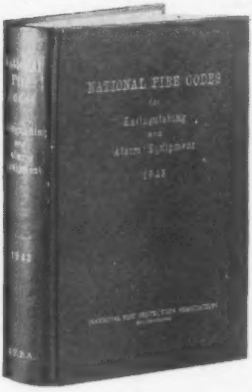

PRICE
$3.00
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This is the book that plant engineers, managers, operators, safety directors, fire marshals, building and insurance inspectors, and those in local, state and federal departments and agencies, who are responsible for fire protection, have been looking for.

This volume brings together for convenient reference the many N.F.P.A. standards dealing with the various types of fire extinguishing and alarm equipment and related features of supervision, maintenance, and organization.

Place Your Order Today!

NATIONAL FIRE PROTECTION ASSN.
INTERNATIONAL
60 Batterymarch St., Boston, Mass.

Welding Curtains of Dandux Flameproofed Canvas working for Victory in a busy war plant.

PRODUCTION SPEEDED
TIME and SPACE SAVED
COSTS CUT . . *Safely* ★

Today Dandux Flameproofed Canvas is safely speeding production in scores of war plants—hastening the tomorrow when Dandux will be available for the more complete protection of civilian life and property.

Daniels, you know, makes not only flameproofed canvas and Dandux Stop-Fire flame and waterproofing solution, but fabricates finished covers, tarpaulins and special equipment to meet every canvas need of every industry.

★ *thanks to...*

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Manufacturers of Everything of Canvas

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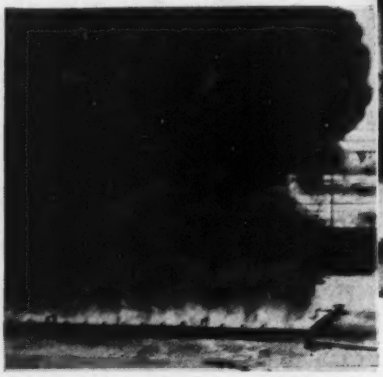
DANDUX FLAMEPROOFED CANVAS

USE WATER IN A NEW FORM TO DEFEAT EVEN OIL FIRES!

Now you can rely on water — your natural, ever-plentiful ally against fire — to protect your plant from a much *broader* range of hazards. Where water, in the form of stream or spray, might only *spread* the danger — water in the form of Rockwood WaterFOG, confines the fire, cools it, smothers it — *even the most dangerous flammable liquid fires!*

WaterFOG consists of water particles very much finer than spray, created by



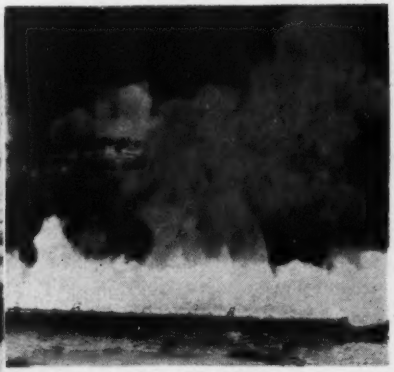
impinging streams of water from specially-designed Rockwood heads. Penetrating gently into the combustion area, WaterFOG absorbs heat, and upon changing into steam, expands with an irresistible smothering action, enveloping the fire in an all-cooling, all-quenching blanket. "Flash-back" is prevented. Costly damage from chemicals and excessive water is avoided. A non-conductor, WaterFOG is approved for fires in electrical equipment.

Check all hazards — now! Quench and dip tanks? Paint shops? Dryers? Oil cellars? Transformers? Oil switches and other electrical equipment? Whatever your oil hazards, you'll find WaterFOG your safest protection against fire.

Transformer Fire — Attacked Successfully by WaterFOG

Internal short circuit . . . disconnecting switch box (oil-submerged) ruptured . . . fire! . . . then WaterFOG went into action. Fire out even before trouble was located! No conflagration. No damage to transformer.

Rockwood WaterFOG, properly installed, is approved by Underwriters' Laboratories and Associated Factory Mutuals. Fixed installations and portable. U. S. Government demand makes necessary high priorities to insure prompt delivery. An educational 16-mm. color moving picture, with sound,



Raging oil fire cut off in mid-air — fire out in seconds!

showing tests for insurance approval, is available upon request from an *executive* of your firm. Write, today, for Bulletin 123.

ROCKWOOD SPRINKLER CO.
56 Harlow Street, Worcester, Mass.

ROCKWOOD WaterFOG

WATER, ENGINEERED BY ROCKWOOD, COOLS, CONFINES, SMOTHERS OIL FIRES

WHERE IS THE NEAREST FIRE ALARM BOX?

for FIRE
USE THE NEAREST BOX
NO.
AT
and wait for the Firemen
DO YOU KNOW THAT
600,000
fires occur annually in the U.S.A.
10,000
human lives are lost and
100,000
others are seriously injured and
$400,000,000
in property values plus the indirect losses creating a total waste in excess of One Billion dollars are annually destroyed by Fire.
70%
of the fires — and fire losses occur in dwellings.
43%
of the commercial establishments destroyed do not rebuild, and the community loses prestige, business, payrolls, taxes and wealth.
50
times its original size is the spread of fire within 8 minutes after inception.
WHEN FIRE OCCURS—
Use the Box IMMEDIATELY
Delayed Alarms are largely responsible for the excessive Fire Loss.
The Box Is Your Best Protection
FIRE DEPARTMENT

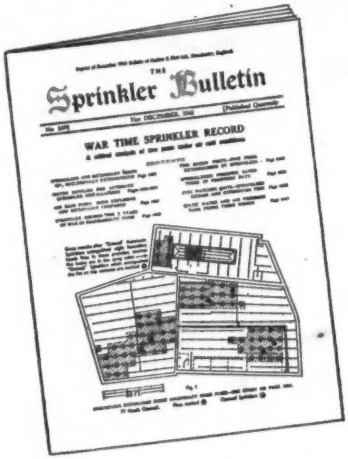
INSTRUCTION CARDS PROMINENTLY DISPLAYED

in every building will inspire "fire consciousness" and proper action when fire occurs. Fire signaling facilities were never more urgently needed, but scarcity of materials necessitates greater dependence upon existing boxes. Their prompt use for fire will conserve national resources.

THE GAMEWELL COMPANY

NEWTON UPPER FALLS, MASSACHUSETTS

England's Report



on Sprinkler Fire Protection!

Here is an amazing report from the scene of history's worst fire perils. It is an authentic record of the performance of automatic sprinkler fire protection in actual air raids. And it shows that no premises fully protected by automatic sprinklers with a dependable water supply have been destroyed by incendiary bomb fires in England!

Reprinted for the first time in this country, this Bulletin throws new light on protective measures against impending incendiary bombings on our own continent . . . 250 incendiary bombing incidents in sprinkler equipped buildings throughout industrial Britain form the basis of this Report.

Complimentary copies are available for the asking.

Grinnell Company, Inc., Executive Offices, Providence, R. I.

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